

**Maintenance
and Service
Guide**

HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software

Product Version: 8.8-1

Third Edition (March 2005)

Part Number: EK-G80MS-SA. C01

This guide provides step-by-step hardware and firmware installation instructions for HP StorageWorks HSG60 and HSG80 array controllers. It also serves as a reference for the operation, troubleshooting, and future upgrades of these array controllers.



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about this guide

This maintenance and service guide provides information to help you:

- Identify, remove, and replace HP StorageWorks BA370, M2100, and M2200 enclosure components.
- Upgrade HP StorageWorks HSG60 or HSG80 array controller firmware.

“About this Guide” topics include:

- [Overview](#), page 14
- [Conventions](#), page 18
- [Rack stability](#), page 21
- [Getting help](#), page 22

Overview

This section covers the following topics:

- [Intended audience](#)
- [Prerequisites](#)
- [Related documentation](#)

Intended audience

This book is intended for use by users who are experienced with the following:

- HSG60 and HSG80 array controllers
- HP StorageWorks Array Controller Software (ACS), V8.7x-x
- HP StorageWorks BA370 enclosure and enclosure components or HP StorageWorks M2100 and M2200 enclosures and enclosure components

Prerequisites

Before you complete procedures in this document, observe the following precautions:



Caution: Failure to observe the precautions below may result in damage to your equipment.

- Thoroughly review and observe the requirements and precautions described in the “[Common Replacement Information and Procedures](#)” chapter that starts on page 45.
- Know what version of ACS is currently in use.
- Know which enclosure model is currently in use.
- Determine whether the subsystem controllers are in a single or dual-redundant configuration.
- Familiarize yourself with your specific subsystem configuration details.

- Determine the model and types of components installed in your enclosure. The procedures in this document are specific to HSG60 and HSG80 array controllers in BA370, Model 2100, and Model 2200 enclosures. Component part numbers are detailed in the “[General Description](#)” section, which starts on page 23.

Related documentation

Other documentation relative to HSG60 and HSG80 hardware, software, and firmware is listed in [Table 1](#). To acquire up-to-date information regarding the HSG60 and HSG80 array controllers or ACS, visit the following HP website:

<http://h18006.www1.hp.com/products/storageworks/acs/index.html>

Table 1: Related Documentation

Item	Document Name	Document Part Number
1.	<i>Compaq StorageWorks Modular Array Configuration Guide</i>	EK-MACON-CA
2.	<i>HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Troubleshooting Guide</i>	EK-G80TS-SA. C01
3.	<i>HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Command Line Interface Reference Guide</i>	EK-G80CL-RA. C01
4.	<i>HP StorageWorks Replacing a Gigabit Link Module (GLM) in an HSG60 or HSG80 Array Controller Installation Instructions</i>	EK-80GLM-TE. D01
5.	<i>HP StorageWorks Replacing DIMMs in an HSG60 or HSG80 Cache Module Installation Instructions</i>	EK-80DIM-IM. E01
6.	<i>HP StorageWorks Replacing an HSG60 or HSG80 Cache Module Installation Instructions</i>	EK-80CAH-IM. F01
7.	<i>HP StorageWorks Replacing an HSG60 or HSG80 Array Controller Installation Instructions</i>	EK-80CTL-IM. F01
8.	<i>HP StorageWorks Replacing an External Cache Battery (ECB) Installation Instructions</i>	EK-80ECB-IM. F01
9.	<i>HP StorageWorks HSG80 ACS Solution Software Version 8.8 for HP-UX Installation and Configuration Guide</i>	AA-RV1FA-TE
10.	<i>HP StorageWorks HSG80 Enterprise/Modular Storage RAID Array Fibre Channel Solution Software Version 8.8 for HP-UX Release Notes</i>	AA-RV1GA-TE
11.	<i>HP StorageWorks HSG80 ACS Solution Software Version 8.8 for IBM AIX Installation and Configuration Guide</i>	AA-RV1HA-TE

Table 1: Related Documentation (continued)

Item	Document Name	Document Part Number
12.	<i>HP StorageWorks HSG80 Enterprise/Modular Storage RAID Array Fibre Channel Solution Software Version 8.8 for IBM AIX Release Notes</i>	AA-RV1JA-TE
13.	<i>HP StorageWorks HSG80 Enterprise/Modular Storage RAID Array Fibre Channel Solution Software Version 8.8 for Linux X86 and Alpha Release Notes</i>	AA-RV1KA-TE
14.	<i>HP StorageWorks HSG80 ACS Solution Software Version 8.8 for LINUX X86 and Alpha Installation and Configuration Guide</i>	AA-RV1LA-TE
15.	<i>HP StorageWorks HSG80 ACS Solution Software Version 8.8 for Novell NetWare Installation and Configuration Guide</i>	AA- RV1MA -TE
16.	<i>HP StorageWorks HSG80 Enterprise/Modular Storage RAID Array Fibre Channel Solution Software Version 8.8 for Novell NetWare Release Notes</i>	AA- RV1NA -TE
17.	<i>HP StorageWorks HSG80 ACS Solution Software Version 8.8 for OpenVMS Installation and Configuration Guide</i>	AA- RV1PA -TE
18.	<i>HP StorageWorks HSG80 Enterprise/Modular Storage RAID Array Fibre Channel Solution Software Version 8.8 for OpenVMS Release Notes</i>	AA- RV1QA -TE
19.	<i>HP StorageWorks HSG80 ACS Solution Software Version 8.8 for Sun Solaris Installation and Configuration Guide</i>	AA- RV1RA -TE
20.	<i>HP StorageWorks HSG80 Enterprise/Modular Storage RAID Array Fibre Channel Solution Software Version 8.8 for Sun Solaris Release Notes</i>	AA- RV1SA -TE
21.	<i>HP StorageWorks Command Console Version 2.4 Release Notes</i>	AV- RV1TA -TE
22.	<i>HP StorageWorks Command Console Version 2.4 User Guide</i>	AA- RV1UA -TE
23.	<i>HP StorageWorks Command Console Version 2.4 Online Help (HSG60 and HSG80)</i>	AA-RS20A-TE AA-RS21A-TE
24.	<i>HP StorageWorks HSG80 ACS Solution Software Version 8.8 for Tru64 UNIX Installation and Configuration Guide</i>	AA- RV1VA -TE
25.	<i>HP StorageWorks HSG80 Enterprise/Modular Storage RAID Array Fibre Channel Solution Software Version 8.8 for Tru64 UNIX Release Notes</i>	AA- RV1WA -TE

Table 1: Related Documentation (continued)

Item	Document Name	Document Part Number
26.	<i>Compaq StorageWorks 64-Bit PCI-to-Fibre Channel Host Bus Adapter User Guide</i>	AA-RKPDB-TE
27.	<i>Digital StorageWorks UltraSCSI RAID Enclosure (DS-BA370-Series) User's Guide</i>	EK-BA370-UG. B01
28.	<i>HP StorageWorks HSG80 ACS Solution Software Version 8.8 for Windows Installation and Configuration Guide</i>	AA- RV1XA -TE
29.	<i>HP StorageWorks HSG80 ACS Solution Software Version 8.8 for Windows Release Notes</i>	AA-RV1YA-TE
30.	<i>HP StorageWorks Enterprise/Modular Storage RAID Array Fibre Channel Arbitrated Loop Configurations Application Note</i>	AA-RS1ZB-TE
31.	<i>HP StorageWorks Enterprise/Modular Storage RAID Array Fibre Channel Arbitrated Loop Configurations for Novell Netware Application Note</i>	AA-RVHHA-TE
32.	<i>HP StorageWorks Addendum for ACS Solution Software - Differences Between HSG60 and HSG80 Array Controllers</i>	AV-RV2MA-TE

Conventions

Conventions consist of the following:

- [Document conventions](#)
- [Text symbols](#)
- [Equipment symbols](#)

Document conventions

This document follows the conventions in [Table 2](#).

Table 2: Document conventions

Convention	Element
Blue text: Figure 1	Cross-reference links
Bold	Menu items, buttons, keys, tabs, and box names
<i>Italics</i>	Text emphasis and document titles in body text
Monospace font	User input, commands, code, file and directory names, and system responses (output and messages)
<i>Monospace, italic font</i>	Command-line and code variables
Blue underlined sans serif font text (http://www.hp.com)	Website addresses

Text symbols

The following symbols may be found in the text of this guide. They have the following meanings:



WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or death.



Caution: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or data.

Tip: Text in a tip provides additional help to readers by providing nonessential or optional techniques, procedures, or shortcuts.

Note: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Equipment symbols

The following equipment symbols may be found on hardware for which this guide pertains. They have the following meanings:



Any enclosed surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

WARNING: To reduce the risk of personal injury from electrical shock hazards, do not open this enclosure.



Any RJ-45 receptacle marked with these symbols indicates a network interface connection.

WARNING: To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.



Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. Contact with this surface could result in injury.

WARNING: To reduce the risk of personal injury from a hot component, allow the surface to cool before touching.



Power supplies or systems marked with these symbols indicate the presence of multiple sources of power.

WARNING: To reduce the risk of personal injury from electrical shock, remove all power cords to completely disconnect power from the power supplies and systems.



Any product or assembly marked with these symbols indicates that the component exceeds the recommended weight for one individual to handle safely.

WARNING: To reduce the risk of personal injury or damage to the equipment, observe local occupational health and safety requirements and guidelines for manually handling material.

Rack stability

Rack stability protects personnel and equipment.



WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
 - The full weight of the rack rests on the leveling jacks.
 - In single rack installations, the stabilizing feet are attached to the rack.
 - In multiple rack installations, the racks are coupled.
 - Only one rack component is extended at any time. A rack may become unstable if more than one rack component is extended for any reason.
-

Getting help

If you still have a question after reading this guide, contact an HP authorized service provider or access our website: <http://www.hp.com>.

HP technical support

Telephone numbers for worldwide technical support are listed on the following HP website: <http://www.hp.com/support/>. From this website, select the country of origin.

Note: For continuous quality improvement, calls may be recorded or monitored.

Be sure to have the following information available before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

HP storage website

The HP website has the latest information on this product, as well as the latest drivers. Access storage at: <http://www.hp.com/country/us/eng/prodserv/storage.html>. From this website, select the appropriate product or solution.

HP authorized reseller

For the name of your nearest HP authorized reseller:

- In the United States, call 1-800-345-1518.
- Elsewhere, visit <http://www.hp.com> and click **Contact HP** to find locations and telephone numbers

General Description

1

This chapter illustrates and describes HSG60 and HSG80 subsystems and their components:

- [Subsystem components—exploded views](#), page 24
- [Connectors, switches, and LEDs](#), page 35

Information regarding these components apply to the following enclosures:

- HP StorageWorks BA370 enclosure
- HP StorageWorks Model 2100 enclosure
- HP StorageWorks Model 2200 enclosure

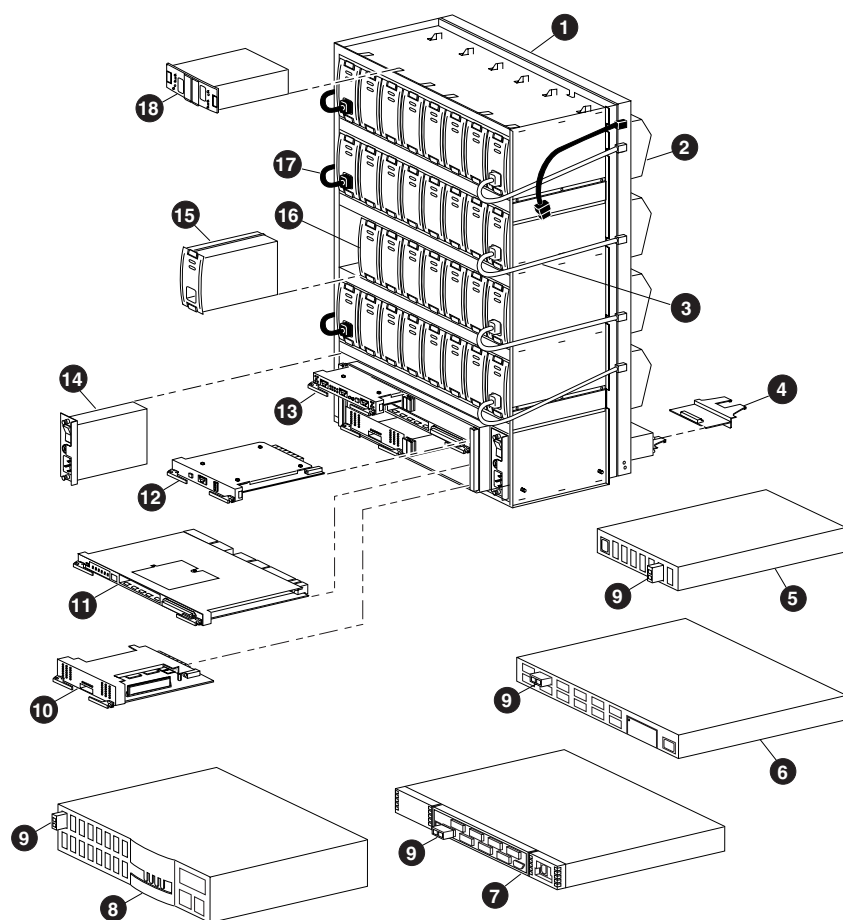
Refer to the Fibre Channel switch and host bus adapter (HBA) documentation that came with the switch kit for specifics on how a switch or HBA operates.

Subsystem components—exploded views

This section illustrates the various subsystem enclosures and components, and it describes specific attributes of each component. Spare part numbers are included, as a convenience, under two part numbering systems (the 6–3 system and the 2–5–2 system).

HSG80 subsystem in a BA370 enclosure

[Figure 1](#) on page 25 and [Table 3](#) on page 26 identify an HSG80 subsystem in a BA370 enclosure.



CXO7180A

- | | |
|--------------------------------------|--|
| ① BA370 rack-mountable enclosure | ⑩ Cache module |
| ② Cooling fan | ⑪ HSG8 array controller |
| ③ Power cable kit | ⑫ Power verification and addressing module |
| ④ I/O module | ⑬ Environmental monitoring unit (EMU) |
| ⑤ Fibre channel hub, 7-port | ⑭ AC input box |
| ⑥ Fibre channel hub, 12-port | ⑮ 180-watt power supply |
| ⑦ Fibre channel hum, 8 port | ⑯ Disk drive |
| ⑧ Fibre channel switch, 16-port | ⑰ Power cable |
| ⑨ Gigabit interface converter (GBIC) | ⑱ External cache battery |

Figure 1: HSG80 subsystem in a BA370 enclosure

Table 3: HSG80 subsystem components and part numbers for BA370 enclosures

Item	Description	6-3 Part Number	2-5-2 Part Number
❶	BA370 rack-mountable enclosure	401914-001	DS-BA370-MA
❷	Cooling fan, blue Cooling fan, gray	400293-001 402602-001	FC-BA35X-MK FC-BA35X-ML
❸	Power cable kit, white	401916-001	17-03718-10
❹	Input/output (I/O) module, blue I/O module, gray	400294-001 401911-001	FC-BA35X-MN 70-32856-S2
❺	Fibre Channel hub, 7-port	234454-001	FE-09061-01
❻	Fibre Channel hub, 12-port	340858-001	30-50549-01
❼	Fibre Channel switch, 8-port	127660-001 167649-001	30-56042-S1 30-56132-S1
❽	Fibre Channel switch, 16-port	127660-002 167650-001	30-56042-S2 30-56132-S2
❾	Gigabit interface converter (GBIC), short wave GBIC, long wave	234458-001 340420-001	FE-09086-01 FD-89504-01
❿	Cache module (original) Cache module (upgraded)	400295-001 400295-002	70-33256-S1 70-33256-S2
⓫	HP StorageWorks HSG80 array controller	400285-001	70-33259-S1
⓬	Power verification and addressing (PVA) module with uninterruptible power supply (UPS) support	155057-003	70-33253-S3
⓭	Environmental monitoring unit (EMU)	400286-001	FC-BA35X-EB
⓮	AC input box	400287-001	FC-BA35X-HE
⓯	180-watt power supply	400288-001	FC-BA35X-HH

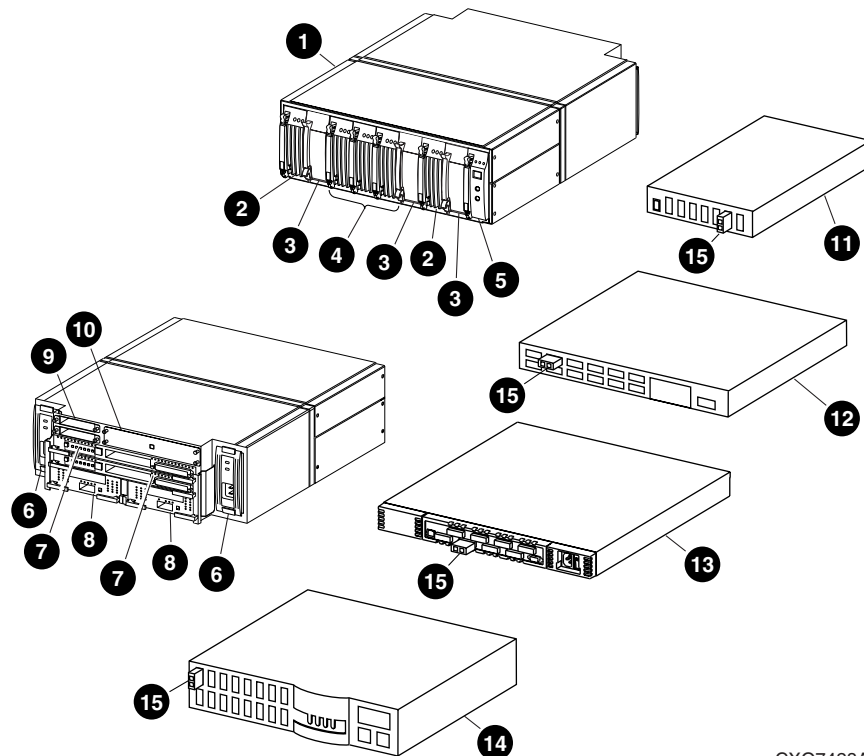
Table 3: HSG80 subsystem components and part numbers for BA370 enclosures (continued)

Item	Description	6-3 Part Number	2-5-2 Part Number
16	Disk drives (4 GB to 18 GB drives)	various ¹	various
17	Power cable, gray Power cable, black	401915-001 401916-001	17-03718-09 17-03718-10
18	External cache battery (ECB), dual (shown) ECB, single (not shown)	400291-001 400292-001	FC-HS35X-BD FC-HS35X-BC

1. Contact HP support for disk drive part numbers.

HSG60 and HSG80 subsystems in Model 2100 and 2200 enclosures

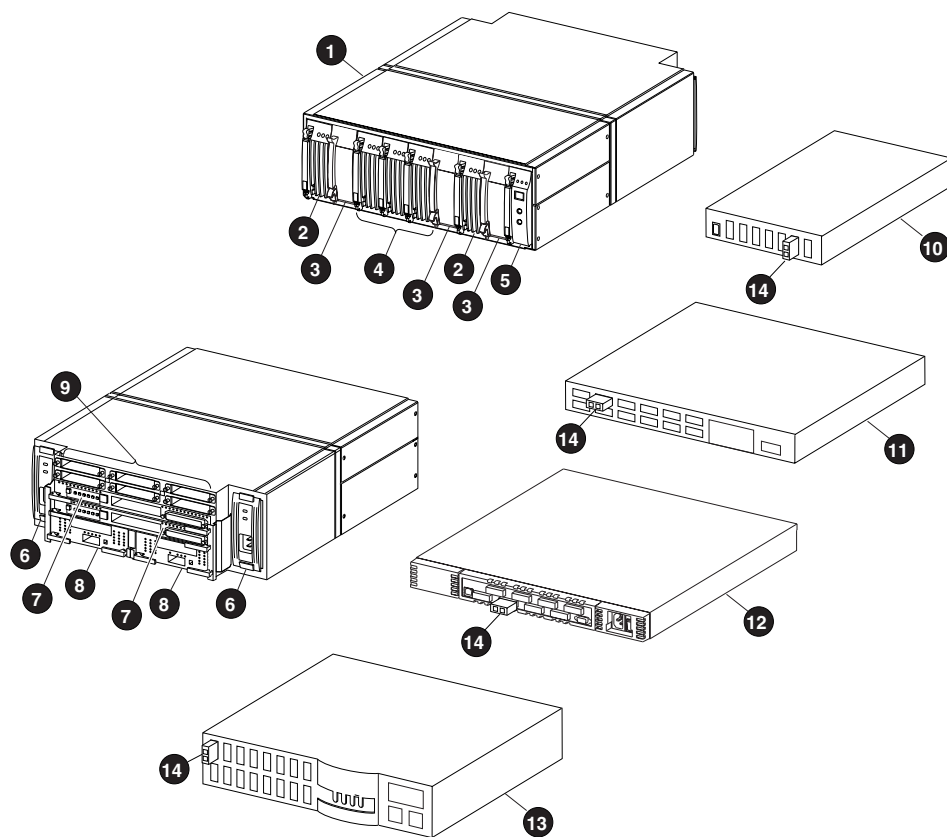
Figure 2, Figure 3 (on page 29) and Table 4 (on page 30) identify HSG60 and HSG80 subsystems in Model 2100 and 2200 enclosures.



CXO7428A

- | | |
|--|---------------------------------|
| ❶ Model 2100 and 2200 rack-mountable enclosure | ❸ Cache module |
| ❷ ECB | ❹ I/O module |
| ❸ Blank bezel | ❺ External cache battery |
| ❹ Fan | ❻ Blank bezel |
| ❺ EMU | ❼ Fibre channel hub, 7-port |
| ❻ 180-watt power supply | ❽ Fibre channel hub, 12-port |
| ❼ HSG60/HSG80 array controller | ❾ Fibre channel switch, 16-port |

Figure 2: HSG60 subsystem in a Model 2100 enclosure



CXO7176A

- | | |
|--|---------------------------------|
| ① Model 2100 and 2200 rack-mountable enclosure | ⑧ Cache module |
| ② ECB | ⑨ I/O module |
| ③ Blank bezel | ⑩ External cache battery |
| ④ Fan | ⑪ Blank bezel |
| ⑤ EMU | ⑫ Fibre channel hub, 7-port |
| ⑥ 180-watt power supply | ⑬ Fibre channel hub, 12-port |
| ⑦ Array controller | ⑭ Fibre channel switch, 16-port |

Figure 3: HSG80 subsystem in a Model 2200 enclosure

Table 4: HSG60 and HSG80 subsystem components and part numbers for Model 2100 and 2200 enclosures

Item	Description	6-3 Part Number	2-5-2 Part Number
❶	Model 2100 and 2200 rack-mountable enclosure	126314-001	70-33725-S1
❷	ECB without a battery pack ECB battery pack	126312-001 147514-001	70-33547-S1 12-44670-S4
❸	Blank bezel	173406-001	74-60460-01
❹	Fan	126310-001	70-33538-S1
❺	EMU	126315-001	70-40081-S1
❻	180-watt power supply	400288-001	FC-BA35X-HH
❼	HSG60 and HSG80 array controller	400285-001	70-33259-S21
❽	Cache module (upgraded)	400295-002	70-33256-S2
❾	I/O modules	126313-001	70-33724-S1
❿	Blank bezel	173405-001	74-60460-01
⓫	Fibre Channel hub, 7-port	234454-001	FE-09061-01
⓬	Fibre Channel hub, 12-port	340858-001	30-50549-01
⓬	Fibre Channel switch, 8-port	127660-001 167649-001	30-56042-S1 30-56132-S1
⓭	Fibre Channel switch, 16-port	127660-002 167650-001	30-56042-S2 30-56132-S2
⓮	GBIC, short wave GBIC, long wave	234458-001 340420-001	FE-09086-01 FD-89504-01

BA370 enclosure EMU

Figure 4 and Table 5 identify the Environmental Monitoring Unit (EMU) and EMU-EMU communication cable for BA370 enclosures.

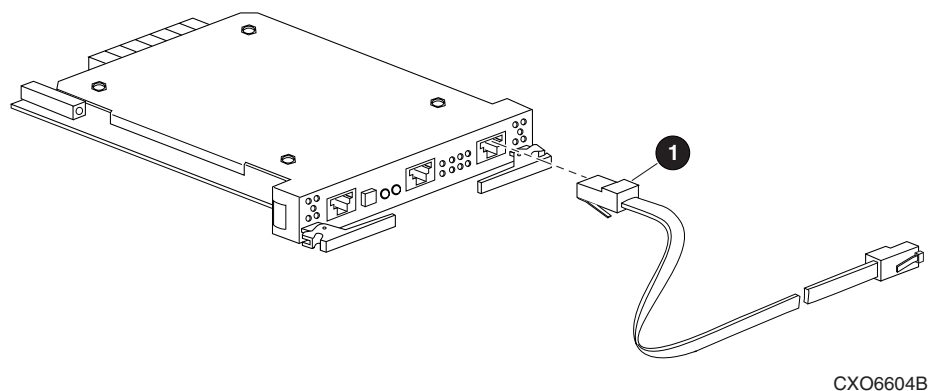


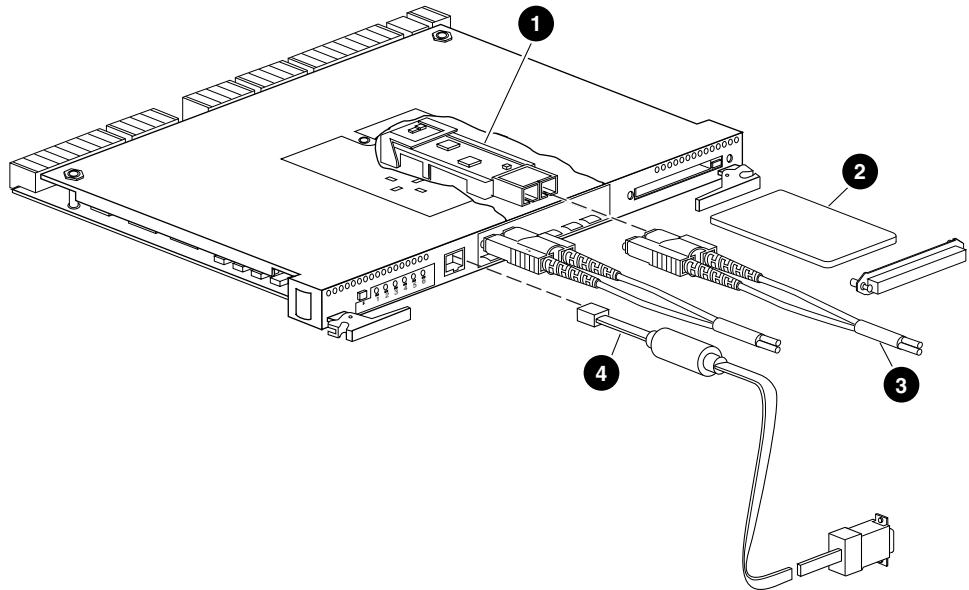
Figure 4: BA370 enclosure EMU and EMU-EMU communication cable

Table 5: BA370 EMU communication cable

Item	Description	6-3 Part Number	2-5-2 Part Number
❶	EMU-EMU communication cable, 4 meter	401949-001	17-03194-04

HSG60 and HSG80 array controllers

Figure 5 and Table 6 (on page 33) identify an array controller, the location of the program card or PCMCIA (Personal Computer Memory Card International Association) card, and how to connect a fiber optic cable and maintenance port cable. This setup applies to BA370, Model 2100, and Model 2200 enclosures.



5016

Figure 5: Array controller—GLM, cabling, and program card

Table 6: HSG60 and HSG80 array controller assembly

Item	Description	6-3 Part Number	2-5-2 Part Number
❶	Gigabit link module (GLM)	402603-001	70-GLMS1-02
❷	Program card: - ACS V8.8-1F - ACS V8.8-1G - ACS V8.8-1L (HSG60 only) - ACS V8.8-1P - ACS V8.8-1S		BG-RHQEJ-BA BG-RFNUH-BA BG-RMC5G-BA BG-RHQDJ-BA BG-RKEGH-BA
❸	Fiber optic cable, 2 meter Fiber optic cable, 5 meter Fiber optic cable, 15 meter Fiber optic cable, 30 meter Fiber optic cable, 50 meter	242796-001 242796-002 242796-003 401937-001 401938-001	17-04820-03 17-04820-05 17-04820-13 17-04820-08 17-04820-09
❹	Maintenance port cable to a PC Optional adapters, 9-pin D-sub to 25-pin D-sub (not shown): - Male to female (null modem) - Male to male (null modem) - Male to male (modem)	173408-001 173407-001 173407-002 173407-003	17-04074-04 12-45238-01 12-45238-02 12-45238-03

Cache module

Figure 6 and Table 7 identify the cache module and the location of the dual inline memory module (DIMM). The bezel of the upgraded cache module is labeled *HSx80 CACHE*.



Caution: An older version of the HP StorageWorks cache module (part number 70-33256-01) cannot be used in Model 2100 and 2200 enclosures. These enclosures require the updated version (part number 70-33256-11, spare part number 70-33256-S1) to function properly. Failure to use the updated version causes the array controller to become dysfunctional upon starting.

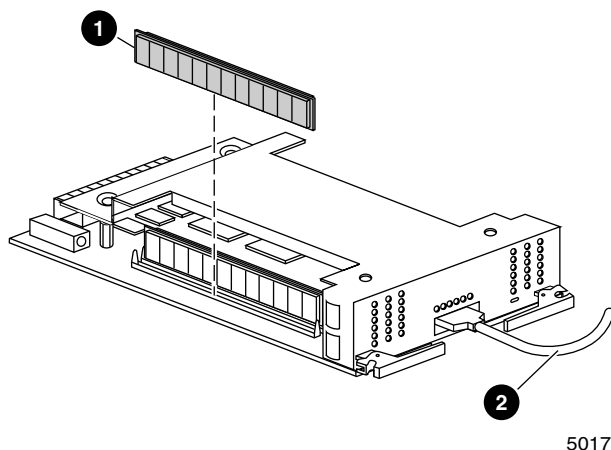


Figure 6: Cache module

Table 7: Cache module

Item	Description	6-3 Part Number	2-5-2 Part Number
❶	DIMM, 32 MB DIMM, 128 MB	400296-001 400297-001	70-DIMS1-01 70-DIMS1-02
❷	BA370 enclosure only: - ECB Y-cable ¹ , 1 meter - ECB Y-cable, 3 meters	400298-001 401913-001	17-04479-03 17-04479-04

1. Cabling is not applicable to HSG60 subsystems

Connectors, switches, and LEDs

This section provides connector, switch, and LED information for the following components:

- [HSG60 and HSG80 array controller front panel, OCP, and GLM](#)
- [LEDs for a 180-watt power supply](#)
- [BA370 enclosure PVA module connector and switches](#)
- [BA370 enclosure EMU connectors, switches, and LEDs](#)
- [Model 2100 and 2200 enclosure EMU switches and LEDs](#)
- [Model 2100 and 2200 enclosure ECB LEDs](#)
- [Model 2100 and 2200 enclosure fan LEDs](#)

Note: For detailed information pertaining to the power supply, PVA, EMU, ECBs, fans, and I/O module, refer to the specific enclosure user guide.

HSG60 and HSG80 array controller front panel, OCP, and GLM

This section describes the array controller front panel, operator control panel (OCP) switches and LEDs, and gigabit link module (GLM) components.

Front panel

Figure 7 identifies various physical parts of the array controller.

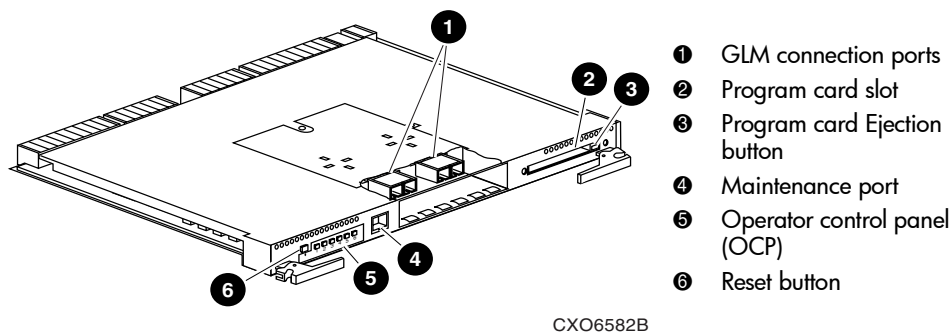


Figure 7: Array controller front panel connectors, switches, and LEDs

OCP switches and LEDs

Figure 8 identifies the OCP switches and LEDs on the HSG80 array controller.

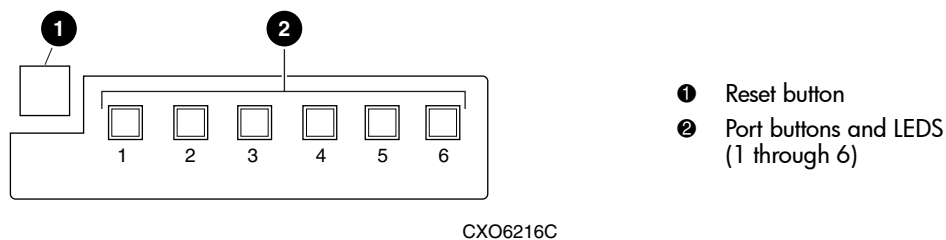
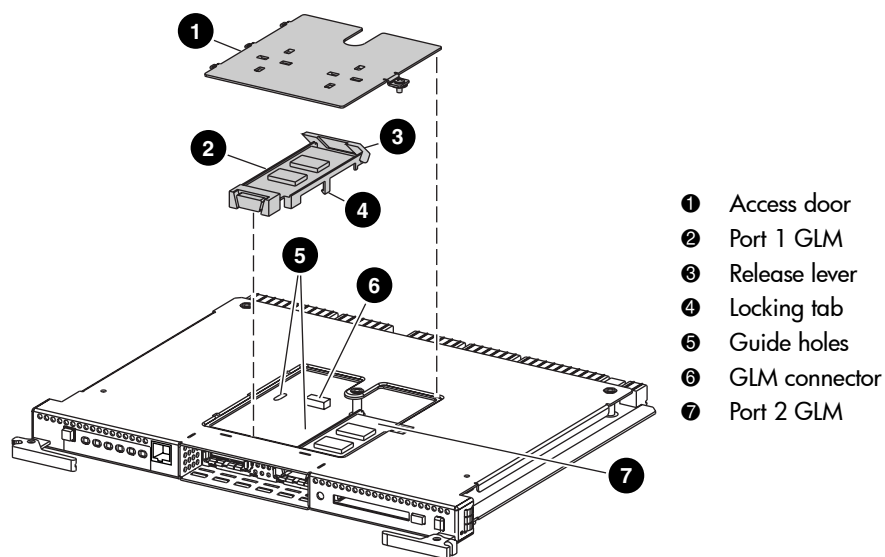


Figure 8: Array controller OCP switches and LEDs

GLM connectors and components

Figure 9 identifies various GLM connectors and components on the array controller.



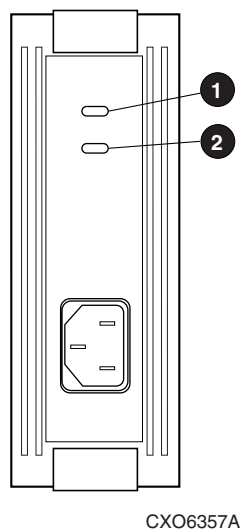
5018

Figure 9: GLM connectors and components

LEDs for a 180-watt power supply

Figure 10 identifies power supply LEDs for BA370, Model 2100, and Model 2200 enclosures.

Note: Refer to the specific enclosure user guide for detailed information.



- ❶ Shelf (enclosure) status LED
- ❷ Power supply status LED

Figure 10: LEDs for a 180-watt power supply

BA370 enclosure PVA module connector and switches

Figure 11 identifies the power verification and addressing (PVA) module connector and switches for BA370 enclosures.

Note: Refer to the BA370 enclosure user guide for detailed information.

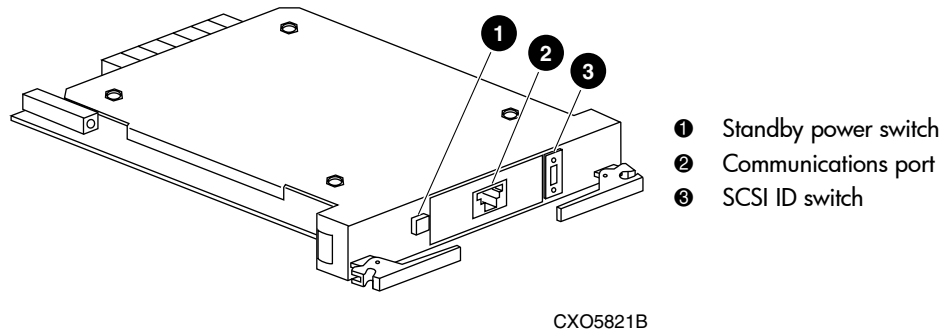


Figure 11: BA370 enclosure PVA module connector and switches

BA370 enclosure EMU connectors, switches, and LEDs

Figure 12 identifies EMU connectors, switches, and LEDs for BA370 enclosures.

Note: Refer to the BA370 enclosure user guide for detailed information.

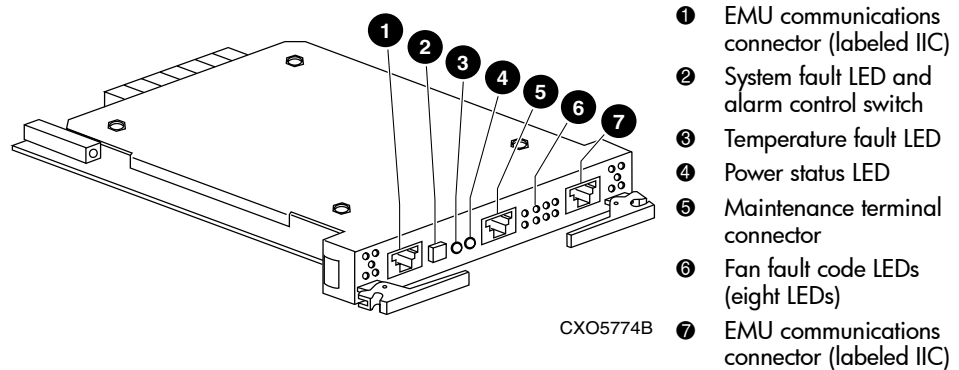


Figure 12: BA370 enclosure EMU connectors, switches, and LEDs

Model 2100 and 2200 enclosure EMU switches and LEDs

Figure 13 identifies EMU switches and LEDs for Model 2100 and 2200 enclosures.

Note: Refer to the Model 2100 and 2200 enclosure user guide for detailed information.

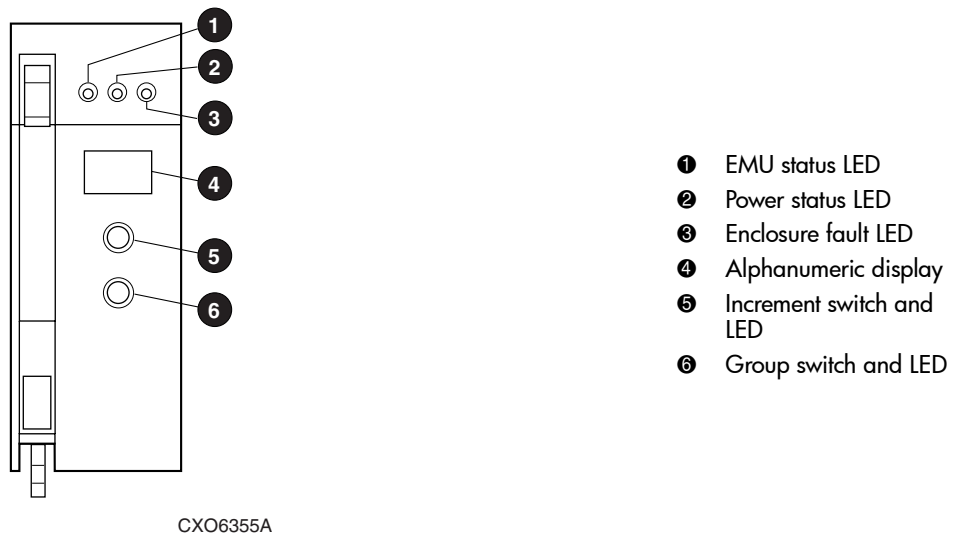


Figure 13: Model 2100 and 2200 enclosure EMU switches and LEDs

Model 2100 and 2200 enclosure ECB LEDs

Figure 14 identifies ECB LEDs for Model 2100 and 2200 enclosures.

Note: Refer to the Model 2100 and 2200 enclosure user guide for detailed information.

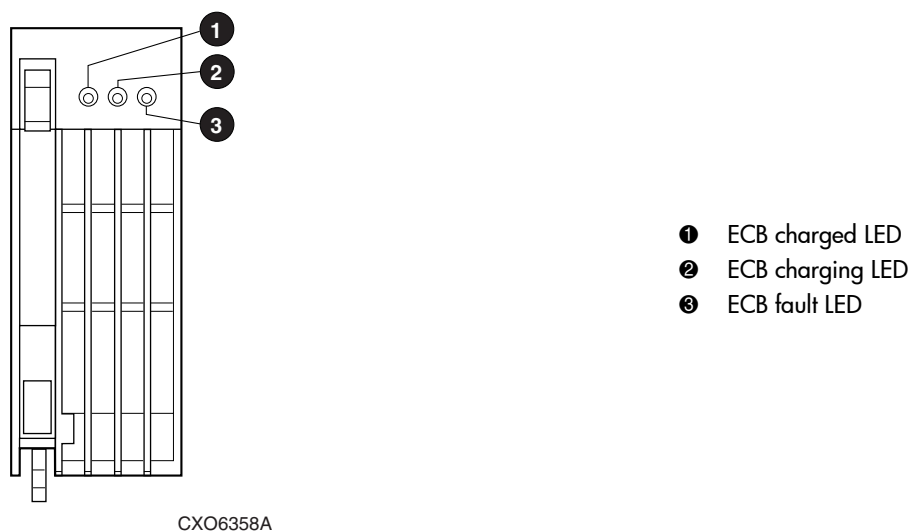


Figure 14: Model 2100 and 2200 enclosure ECB LEDs

Model 2100 and 2200 enclosure fan LEDs

Figure 15 identifies fan LEDs for Model 2100 and 2200 enclosures.

Note: Refer to the Model 2100 and 2200 enclosure user guide for detailed information.

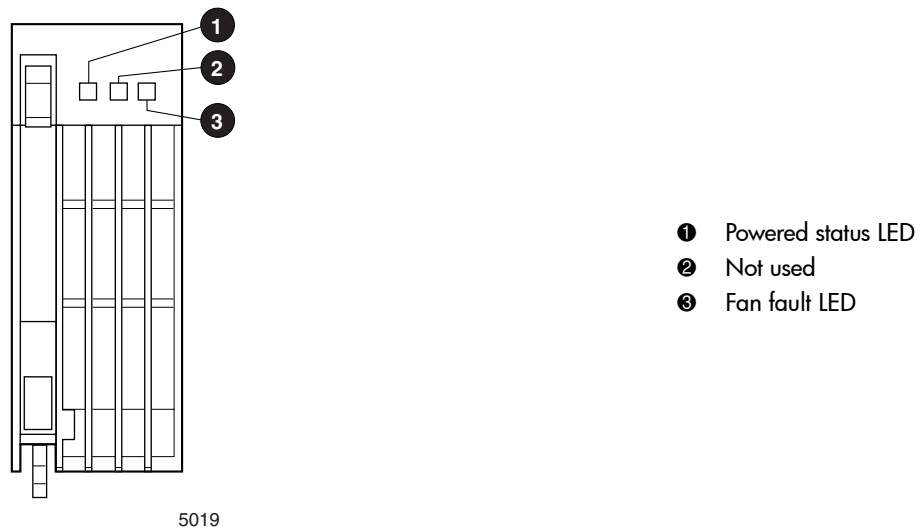


Figure 15: Model 2100 and 2200 enclosure fan LEDs

Common Replacement Information and Procedures

2

This chapter contains the following replacement information and procedures:

- [Required tools](#), page 46
- [Field replacement strategy](#), page 47
- [Precautions](#), page 48
- [Establishing a local connection to the controller](#), page 50
- [Fiber optic cable cleaning instructions](#), page 54
- [Cleaning a GLM](#), page 55
- [Replacing a GLM](#), page 57
- [Replacing a fiber optic cable, switch, or hub](#), page 67
- [Replacing DIMMs](#), page 70
- [Handling storage sets, mirror sets, stripe sets, RAID sets and JBODs](#), page 83
- [Replacing a disk drive](#), page 94
- [Disk drive auto-read-reallocate bit activation](#), page 99



Caution: See the “[Required tools](#),” “[Precautions](#),” “[Establishing a local connection to the controller](#),” and “[Common Replacement Information and Procedures](#)” sections that start on page 46 prior to performing procedures within this chapter. Also, review the “[Prerequisites](#)” section that starts on page 14.

Note: If you are involved in controller outages or you are troubleshooting controller issues, capture (log your terminal session) all CLI activity while the problem is ongoing. Doing this allows HP technical support resources to better assess the problem.

Required tools

The following tools may be needed to service the array controller, cache module, ECB, PVA module, GLM, and I/O module:

- Flathead screwdriver for loosening and tightening the I/O module retaining screws
- Small Phillips screwdriver for loosening and tightening the GLM access door screws
- Pair of thin needle-nose pliers to remove fiber optic cables from the array controller
- Antistatic wrist strap
- Antistatic mat on which to place modules during servicing

Field replacement strategy

HP-authorized service providers troubleshoot HSG60 and HSG80 subsystem problems to the field replaceable unit (FRU) and replace the defective unit. Replacement procedures for subsystem FRUs addressed in this guide include HSG60 and HSG80 array controllers, cache modules, DIMMs, ECBs, and GLMs. One way to replace these components on running subsystems is by using the *Field Replacement Utility (FRUTIL)*.

Note: HP recommends that you perform shutdown FRU replacement procedures, if possible.

Note: If you are using ACS V8.8P with the HP StorageWorks Data Replication Manager (DRM) application, *FRUTIL* cannot be run in remote copy set environments on the target side specifically if I/O is in progress. If the host load is stopped, you can run *FRUTIL* on the initiator or target. If the host load is not quiesced and *FRUTIL* is run while remote copy I/O is running, the normalization process is reset.

Precautions

To prevent accidental damage to subsystem components, always follow the precautions in this section when carrying out the procedures in this guide.

Electrostatic discharge precautions

Static electricity collects on all non-conducting material, such as paper, cloth, and plastic. An electrostatic discharge (ESD) can easily damage the array controller or other subsystem components even though the discharge might not be seen or felt. ESD is a common problem and can cause data loss, system downtime, and other problems. The most common source of static electricity is the movement of people in contact with carpets and clothing. Low humidity increases the amount of static electricity.

Observe the following precautions whenever servicing a subsystem or subsystem component:

- Always use an ESD wrist strap if you are servicing the array controller or other components in the subsystem. Ensure that the strap contacts bare skin, fits snugly, and that the strap grounding lead is attached to a bus with a verified earth ground.
- Before touching any circuit board or component, always touch a verified earth ground to discharge any static electricity that might be present in clothing.
- Always keep circuit boards and components away from non-conducting material.
- Always keep clothing away from circuit boards and components.
- Always use antistatic bags and grounding mats for storing circuit boards or components during replacement procedures.
- Always keep the ESD cover over the program card if the card is in the array controller. If a card is removed, put the card in the original carrying case.
- Never touch the contacts, or twist or bend the program card.
- Never touch the connector pins of a cable if one end is attached to a component or host.

Very-high-density cable interface cable precautions

All cables that connect to the array controller, cache module, and ECB use very-high-density cable interface (VHDCI) connectors. VHDCI connectors have extraordinarily small mating surfaces that can be damaged by dust and cable movement. Always take the following VHDCI precautions when servicing any subsystem component:

- Clean the mating surfaces with only a blast of compressed air or freon.
- Mate the connectors by hand, then tighten the retaining screws to 3.81 cm/kg (1.5 in/lb), approximately 1/4 of an additional turn after the connectors mate.
- Test the cable assembly by gently pulling on the cable. There should be no visible separation between the cable and connector.

Component precautions

System components referenced in this manual comply with regulatory standards documented herein. Use of other components in their place might violate country standards, negate regulatory compliance, or invalidate the product warranty.

Maintenance port precautions

The maintenance port generates, uses, and radiates radio-frequency energy through cables that are connected to this port. This energy can interfere with radio and television reception. Do not leave a cable connected to this port if not communicating with array controllers.

Establishing a local connection to the controller

Communication with an array controller is established locally or remotely. Use a local connection to configure the array controller for the first time. Use a remote connection to the host system for all subsequent configuration tasks. Refer to the controller installation and configuration guide that shipped with the platform kit for details.

Use the maintenance port, located on the front of the array controller, to connect a PC or terminal to the array controller for troubleshooting or configuration procedures. This port accepts a standard RS-232 jack from any EIA-423 compatible terminal or a PC with a terminal-emulation program. The maintenance port supports serial communications with a default value of 9600 baud (using 8 data bits, 1 stop bit, and no parity bit).

Note: The serial maintenance port speed and character format characteristics can be set with the `SET THIS TERMINAL` or `SET OTHER TERMINAL` CLI command. In dual-redundant controller configurations, these characteristics are set independently for each controller.

A controller remembers its current serial port settings across power cycles, restarts, and when it becomes dysfunctional. If the controller is configured as dual-redundant, it also retains the settings of the partner controller, and remembers the other controller when the `SET NOFAILOVER` command is entered.

After one of the following commands is issued (while there are any remembered serial port settings), serial port settings are copied to the (possibly new) partner controller as determined by the copy direction, and copied settings replace the previous settings of that partner.

- `SET FAILOVER COPY=THIS`
- `SET MULTIBUS COPY=THIS`
- `SET FAILOVER COPY=OTHER`
- `SET MULTIBUS COPY=OTHER`

These settings are used when the controller is started with a program card containing ACS firmware. However, any current settings can be overridden after the **Port #5** reset action is performed on a replacement controller with installed firmware. ACS V8.7, V8.7-1, or V8.7-2 forces the controller speed to 19200 baud; and V8.7-3 through V8.8-*x* forces it to 9600 baud (8 bit data, no parity, one stop in both cases).

Tip: Following is an example of how the baud rate is set while replacing a controller:

Example: A controller pair is operating with ACS V8.8-x with the top and bottom at 4800 baud. The bottom controller is to be replaced. As such, you would complete the following steps:

1. Issue the `SET FAILOVER` command on the top controller.
 2. Use `FRUTIL` to replace the bottom controller with a factory fresh controller and a V8.8-x program card.
 3. As part of the installation, initialize the fresh bottom controller with a **Port #5** button reset, which sets the controller speed to 9600 baud.
 4. Later, while Dual-redundant mode is re-established by issuing a `SET MULTIBUS COPY=THIS` or `SET FAILOVER COPY=THIS` on the top controller, the fresh bottom controller reverts to the 4800 baud setting supplied by the top controller as the remembered partner setting.
-

Note: A maintenance port cable (see [Figure 16](#) on page 52) is provided for connecting to a PC. This cable has a 9-pin connector molded onto one end, to which three optional adapters can be attached for making a maintenance terminal connection.

Use the following steps to establish a local connection for setting the initial array controller configuration:

1. Turn off the PC or terminal, and connect the maintenance port cable to the array controller, as shown in [Figure 16](#) on page 52.
 - For a PC connection, plug one end of the maintenance port cable into the communication port of the PC; plug the other end into the array controller maintenance port.
 - For a terminal connection, see [Figure 16](#) on page 52 for cabling information. Adapter part numbers are provided in the “[Subsystem components—exploded views](#)” section (on page 24) under the specific subsystem type.

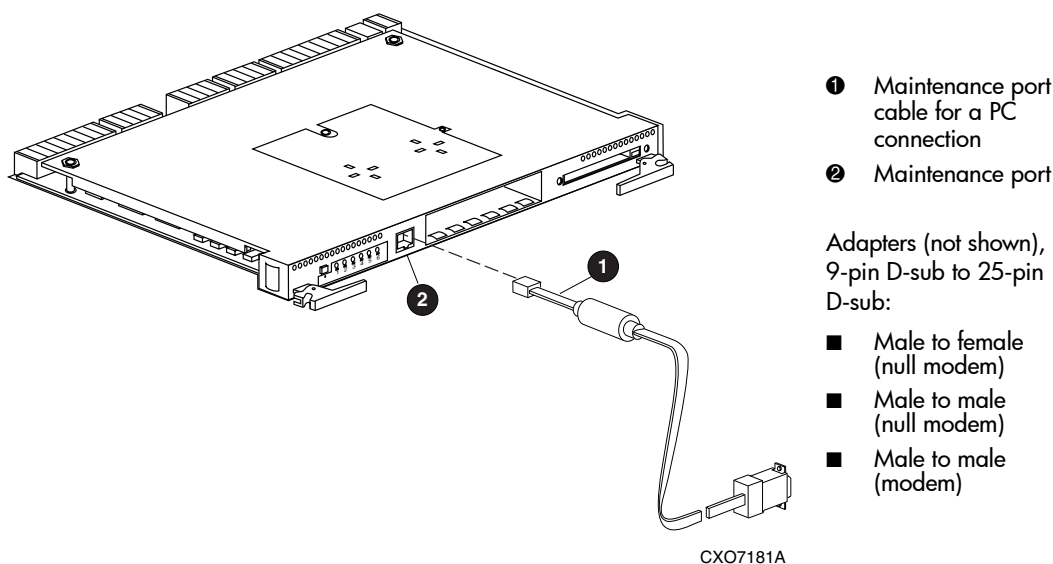


Figure 16: PC and terminal to maintenance port connection



Caution: Connecting a maintenance port cable between the array controller and the PC (or terminal) can cause radio and television interference and cause the subsystem to operate outside Federal Communications Commission (FCC) radiation guidelines and requirements.

To reduce or eliminate any radiated emissions issues, use excellently-shielded serial cables, and ground them appropriately. Also, do *not* leave a maintenance port cable connected to the array controller through the maintenance port unless communication with the array controller is necessary.

2. Turn on the PC or terminal.
3. Configure the terminal emulation software for 9600 baud, 8 data bits, 1 stop bit, and no parity bit.

Note: See the note starting on page 50 and the tip on page 51 for details on the baud rate.

4. Press **Enter** or **Return**.

The CLI prompt appears, indicating that a local connection was established with the array controller.

Note: The default data transfer rate of a new HSG80 array controller using ACS V8.6 and earlier is 9600 baud. (The default data transfer rate for controllers using ACS V8.7 may be set at 19200.) The maximum transfer rate is 19200. If the current configuration uses 19200, use [step 5](#) to establish this rate. See the note starting on page 50 and the tip on page 51 for details on baud rate settings.

5. Complete the following steps if you want to increase the data transfer rate to 19200 baud:

a. Enter one of the following commands:

```
SET THIS_CONTROLLER TERMINAL_SPEED=19200
```

```
SET OTHER_CONTROLLER TERMINAL_SPEED=19200
```

b. Configure the terminal emulation software for 19200 baud.

Tip: If you are entering CLI commands in a dual-redundant configuration, remember that the array controller connected to is “this controller” and the remaining array controller is the “other controller.”

Fiber optic cable cleaning instructions

To ensure optimum performance of the cable, clean the fiber optic cables while replacing the array controller. Use the polyester cloth from the cleaning kit that came with the cable. [Figure 17](#) shows the ferrule on a fiber optic cable.

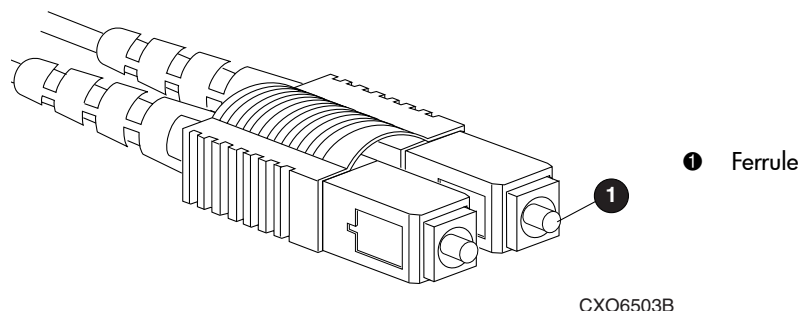


Figure 17: Ferrule on a fiber optic cable



Caution: HP recommends cleaning the fiber optic cable only when replacing the array controller. Overcleaning can cause damage to the ferrules.

Note: If you are installing a fiber optic cable for the first time, omit this procedure.

Use the following steps to clean the ferrule on a fiber optic cable:

1. Using the polyester cleaning cloth that came with the cable cleaning kit, cover your fingers, and squeeze one ferrule between two fingers.
2. Rotate the cloth around the ferrule, one or two times.
3. If the first ferrule is clean, move your fingers to a different area of the cloth and repeat [step 1](#) and [step 2](#) for the remaining ferrule.

Cleaning a GLM

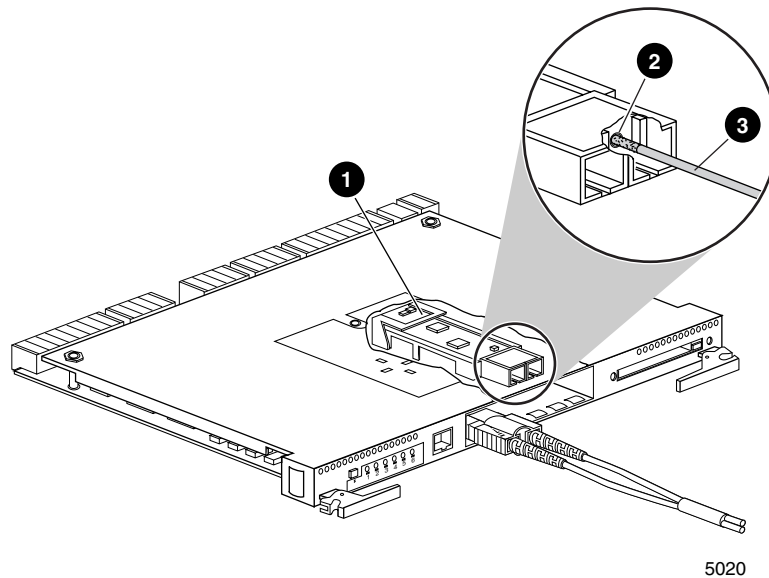
If you are replacing a GLM, clean the GLM receptacles to ensure optimum performance. Use the following steps to clean a GLM:

1. Take the polyester swab from the cleaning kit that came with the fiber optic cable.



Caution: Do not exert excessive force when the swab reaches a stopping point, and do not repeat this procedure frequently. Failure to comply with this caution may cause scratching on the GLM and ultimately damage the fiber optic connection. Overcleaning can damage to the GLM.

2. Gently insert the lint-free polyester swab into the transmit-side of the optical GLM cavity (see [Figure 18](#)).



- ① GLM
- ② Receptacle

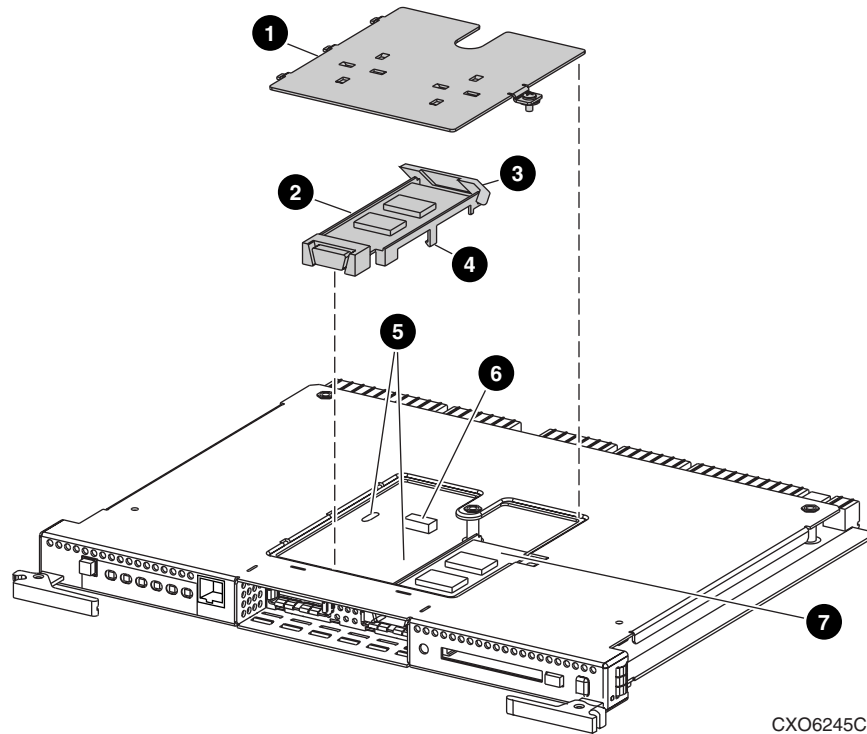
- ③ Swab

Figure 18: Cleaning procedure for GLM

3. Carefully remove dust from the cavity by rotating the swab tip back and forth one or two times.
4. Repeat [step 1](#) (on page 55) through [step 3](#) for the receiving side of the optical GLM cavity.

Replacing a GLM

This section shows you how to replace a GLM in an HSG60 or HSG80 array controller. [Figure 19](#) shows the location and orientation of the GLMs.



- | | |
|-----------------|-----------------|
| ❶ Access door | ❺ Guide holes |
| ❷ Port 1 GLM | ❻ GLM connector |
| ❸ Release lever | ❼ Port 2 GLM |
| ❹ Locking tab | |

Figure 19: Location of GLMs inside an array controller (HSG80 shown)



Caution: ESD can easily damage the array controller or the GLM. Wear a snug-fitting, grounded ESD wrist strap while replacing a GLM.

Replacing a GLM in single-controller configurations

Use the steps in “[Removing a GLM](#)” and “[Installing a GLM](#)” on page 60 to replace a GLM in a single-controller configuration.



Caution: Static electricity can easily damage a controller or GLM. Wear a snug-fitting, grounded electrostatic discharge (ESD) wrist strap.

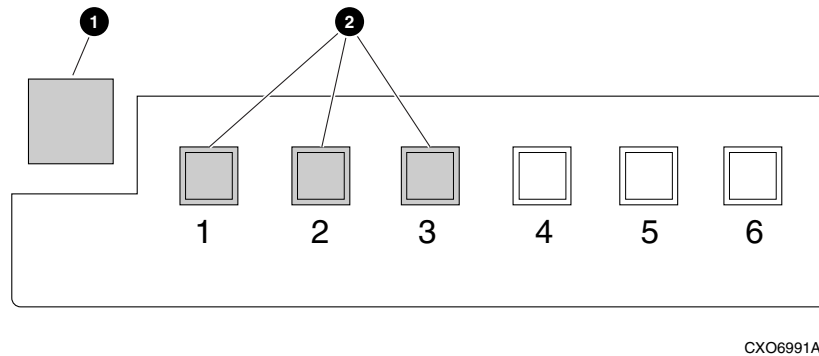
Removing a GLM

Use the following steps to remove a GLM in single-controller configurations:

1. Check the controller to make sure it is operating.
 - Connect a PC or terminal to the controller maintenance port for the failed GLM if the controller is operating.
 - Go to [step 6](#) on page 59 if the controller is not operating.
2. From the host console, stop all host activity to the controller and dismount the logical units in the subsystem.
3. If you are using a Microsoft® Windows 2000® or Windows NT® platform, shut down the server.
4. Run the *Fault Management Utility (FMU)* to obtain last failure codes, if desired.
5. Shut down “this controller” with the following command:

```
SHUTDOWN THIS_CONTROLLER
```

Note: After the controller shuts down, the **Reset** button and the first three port LEDs turn on (see [Figure 20](#) on page 59). This process can take several minutes, depending on the amount of data that needs to be flushed from the cache module.



❶ Reset button

❷ First three port LEDs

Figure 20: Controller Reset button and first three port LEDs on the OCP

6. Disconnect all host bus cables from the controller.



Caution: For fiber optic cables without extender clips, thin needle nose pliers must be used to remove the cable from the controller without potentially damaging the cable (see [Figure 21](#)).

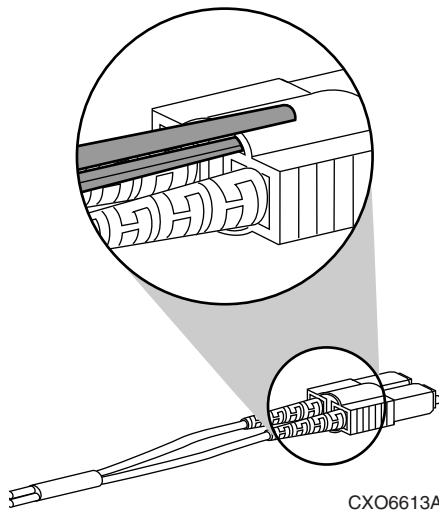


Figure 21: Using thin needle nose pliers to disconnect a fiber optic cable

7. If connected to an operational controller, disconnect the PC or terminal from the controller maintenance port.
8. Disengage both retaining levers and remove the controller containing the failed GLM from the enclosure, and then place the controller on an antistatic bag or a grounded antistatic mat.
9. Remove the screw that secures the access door on top of the controller.
10. Remove the access door and set the door aside.
11. Disengage the GLM locking tabs that protrude through the guide holes on the bottom side of the controller.
12. Operate the release lever on the exposed end of the GLM by pressing the lower end of the release lever with your index finger, while pulling the raised end up with your thumb.
13. Remove the GLM.

Installing a GLM

Use the following steps to install a GLM in single-controller configurations.

Note: Before inserting the new GLM, locate the holes on the controller board where the GLM is to reside.

1. Insert the new GLM by placing the cable connection end of the GLM through the opening on the front of the controller from the top.
2. Line up the locking tab on the bottom of the replacement GLM with the guide holes in the board, and press firmly to seat the GLM.
3. Press the release lever firmly into place to secure the GLM.
4. Install the access door on top of the controller and secure the door with the screw.



Caution: Carefully align the controller in the appropriate guide rails. Misalignment can damage the backplane.

5. Insert the controller and engage the retaining levers.

Note: After fully seated, the controller starts automatically—the **Reset** LED turns on. A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

Note: If the controller did not restart, use the following steps:

- a. Press and hold the controller **Reset** button.
 - b. Reseat the controller program card.
 - c. Release the **Reset** button.
-

6. Connect a PC or terminal to the controller maintenance port.
7. From the CLI prompt, display details about the configured controller using the following command:

```
SHOW THIS_CONTROLLER FULL
```

8. Set the date and time using the following command:

```
SET THIS_CONTROLLER TIME=dd-mm-yyyy:hh:mm:ss
```

9. Connect all host bus cables to the controller.
10. Mount the logical units on the host.
11. If using a Windows 2000 or Windows NT platform, restart the server.
12. Disconnect the PC or terminal from the controller maintenance port.

Replacing a GLM in dual-redundant controller configurations

Use the steps in “[Removing a GLM](#)” and “[Installing a GLM](#)” to replace a GLM in dual-redundant controller configurations.



Caution: Static electricity can easily damage a controller or GLM. Wear a snug-fitting, ESD wrist strap.

Removing a GLM

Use the following steps to remove a GLM in dual-redundant configurations:

1. Connect a PC or terminal to the maintenance port of the operational controller.

Note: The controller connected to the PC or terminal becomes “this controller,” and the controller being removed becomes the “other controller.”

2. Disable failover and take the controllers out of the dual-redundant configuration with one of the following commands:

```
SET NOFAILOVER
```

or

```
SET NOMULTIBUS_FAILOVER
```

3. Start the *FRUTIL* with the following command:

```
RUN FRUTIL
```

4. Enter **N(o)** to the question about replacing the cache battery.
5. Enter **1** for the remove a controller or cache module option.
6. Enter **2** for the remove “other controller” option.
7. Enter **Y(es)** to confirm the intent to remove the “other controller.”



Caution: Wait for *FRUTIL* to quiesce the device ports—indicated by an “All device ports quiesced” message. Failure to allow the ports to quiesce can result in data loss. Quiescing can take several minutes.

Note: A countdown timer allows a total of 2 minutes to remove the controller. After 2 minutes, “this controller” exits *FRUTIL* and resumes operations. If this happens, return to [step 3](#) and proceed.

8. Remove the “other controller” by using the following substeps:
 - a. Disconnect all host bus cables or terminators from the controller.



Caution: For fiber optic cables without extender clips, thin needle nose pliers must be used to remove the cable from the controller without potentially damaging the cable (see [Figure 21](#) on page 59).

- b. Disengage both retaining levers and remove the controller containing the failed GLM from the enclosure.
 - c. Place the controller on an antistatic bag or a grounded antistatic mat.
9. Enter **N(o)** to the question about a replacement controller.
FRUTIL exits.
10. Remove the screw that secures the access door on top of the controller.
11. Remove the access door and set the door aside.
12. Disengage the GLM locking tabs that protrude through the guide holes on the bottom side of the controller.
13. Operate the release lever on the exposed end of the GLM by pressing the lower end of the release lever with your index finger while pulling the raised end up with your thumb.
14. Remove the GLM.

Installing a GLM

Use the following steps to install a GLM.

Note: Before inserting the new GLM, locate the holes on the controller board where the GLM is to reside.

1. Insert the new GLM by placing the cable connection end of the GLM through the opening on the front of the controller from the top.
2. Line up the locking tab on the bottom of the replacement GLM with the guide holes in the board, and press firmly to seat the GLM.
3. Press the release lever firmly into place to secure the GLM.

4. Install the access door on top of the controller and secure the door with the screw.
5. Connect a PC or terminal to the maintenance port of the operational controller.

Note: The controller connected to the PC or terminal becomes “this controller,” and the controller being installed becomes the “other controller.”

6. Ensure that the controller configuration is customized to your needs, and then record the controller configurations (for example, Failover mode, cache status, serial numbers, SCSI mode, mirrored or nonmirrored information, and so forth).
7. Start *FRUTIL* with the following command:

```
RUN FRUTIL
```
8. Enter **N(o)** to the question about replacing the cache battery.
9. Enter **2** for the install a controller or cache module option.
10. Enter **4** to exit *FRUTIL*.
11. Enter **Y(es)** to confirm intent to install the “other controller.” *FRUTIL* quiesces the device ports and displays a message indicating that the controller is being installed.



Caution: Wait for *FRUTIL* to quiesce the device ports—indicated by an “All device ports quiesced” message. Failure to allow the ports to quiesce can result in data loss. Quiescing can take several minutes.
Carefully align the controller in the appropriate guide rails. Misalignment can damage the backplane.

Note: A countdown timer allows a total of 2 minutes to install the controller. After 2 minutes, “this controller” exits *FRUTIL* and resumes operations. If this happens, return to [step 7](#) and proceed.

12. Insert the controller and engage the retaining levers.

Note: In [step a](#), ensure the program card is not installed in the replacement controller.

- a. Insert the controller (*without the program card installed*) into the appropriate bay, and engage the retaining levers.
- b. Press and hold the controller **Reset** button (see [Figure 22](#)), insert the program card, and continue holding the **Reset** button.
- c. Press and hold controller **Port #5** button (see [Figure 22](#)), release the **Reset** button and continue holding the **Port #5** button for an additional 5 to 20 seconds.

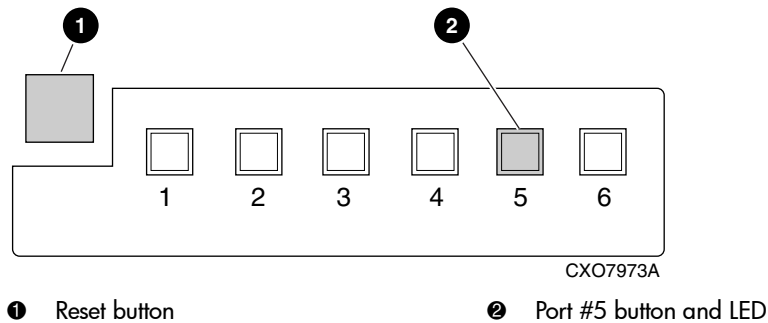


Figure 22: Controller Reset button and Port #5 button on the OCP

The nonvolatile memory in the replacement controller is updated and halts with an LED code of 33.

- d. Press and release the **Reset** button on the controller.
The controller restarts normally.
- e. Wait at least 15 seconds after releasing the **Reset** button and then immediately complete [step 13](#) on page 66. Be sure to wait 15 seconds *before* continuing to [step 13](#) on page 66.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

13. Press **Enter** or **Return** within 3 minutes of completing [substep 12e](#) on page 65 to exit *FRUTIL*, and then wait 1 minute to allow the controller to restart.

Note: If **Enter** or **Return** is not pressed within 3 minutes in step 13 above, the operational controller issues an automated command to cancel the installation of the replaced controller. This cancellation causes all the port LEDs on the controller to go off. If this situation occurs, press Enter to exit *FRUTIL*, and then enter the following command from the operational controller:

```
RESTART OTHER_CONTROLLER
```

14. Configure the controller as described in the appropriate array controller user guide, or refer to the *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Command Line Interface Reference Guide*.



Caution: In [step 15](#), entering the appropriate SET command is critical. Enabling an incorrect failover mode can cause loss of data and incur system downtime.

Verify the original failover configuration and use the appropriate SET command to restore this configuration.

15. Enable failover and re-establish the dual-redundant configuration with one of the following commands:

```
SET FAILOVER COPY=THIS_CONTROLLER
```

or

```
SET MULTIBUS_FAILOVER COPY=THIS_CONTROLLER
```

This command copies the subsystem configuration from “this controller” to the “other controller.”

16. If desired, verify the failover configuration with the following command:

```
SHOW THIS_CONTROLLER FULL
```

17. To verify that the new GLM is functional, enter the following command:

```
SHOW OTHER_CONTROLLER
```

18. Reconnect the host bus cables to the “other controller.”
19. Disconnect the PC or terminal from the controller maintenance port.

Replacing a fiber optic cable, switch, or hub

This section details how to replace a fiber optic cable, switch, or hub.

Removing a fiber optic cable, switch, or hub

Use the following steps to remove a fiber optic cable connected to either side of your switch or hub, or to remove the switch or hub:

1. Shut down the host system (refer to applicable host documentation for more details).
2. Shut down the array controllers:

- In single-controller configurations, shut down “this controller” with the following command:

```
SHUTDOWN THIS_CONTROLLER
```

- In dual-redundant controller configurations, shut down the “other controller” first, and then shut down “this controller” with the following commands:

```
SHUTDOWN OTHER_CONTROLLER
```

```
SHUTDOWN THIS_CONTROLLER
```

Note: After the array controllers shut down, the **Reset** buttons and the first three LEDs turn on (see [Figure 23](#)). This can take several minutes, depending on the amount of data that needs to be flushed from the cache modules. Proceed only after the **Reset** buttons stop flashing and remain solid.



Figure 23: Reset button and first three LEDs

Tip: If you are replacing several cables, a switch, or a hub, label each cable to facilitate installation of the replacement item. Otherwise, subsystem errors can develop from improper connections.

3. If replacing a fiber optic cable without extender clips, disconnect the failed cable at each end using thin needle-nose pliers (see inset on [Figure 24](#)).
If replacing a switch or hub, disconnect all cables connected to the switch or hub.

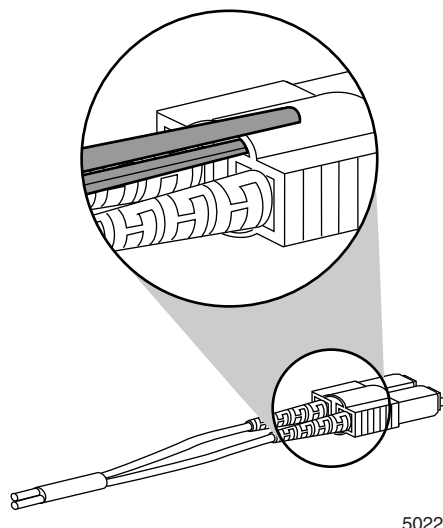


Figure 24: Using thin needle-nose pliers to disconnect a fiber optic cable

Installing a fiber optic cable, switch, or hub

Use the following steps to install a fiber optic cable connected to either side of a switch or hub, or to install a switch or hub:

1. If you are replacing a cable, connect the replacement cable into the ports previously used by the old cable.
2. If you are replacing a switch or hub, reconnect all cables removed from the old switch or hub.

3. Restart each array controller by pressing the **Reset** button.

The array controller automatically restart and the subsystem is now ready for operation.

Tip: If the array controller did not restart, use [step a](#) through [step c](#).

- a. Press and hold the **Reset** button.
 - b. Reseat the array controller program card.
 - c. Release the **Reset** button.
-

4. Restart the host system using host documentation.

Replacing DIMMs

This section shows you how to replace DIMMs in a cache module. DIMM locations are shown in [Figure 25](#) and supported configurations in [Table 8](#).

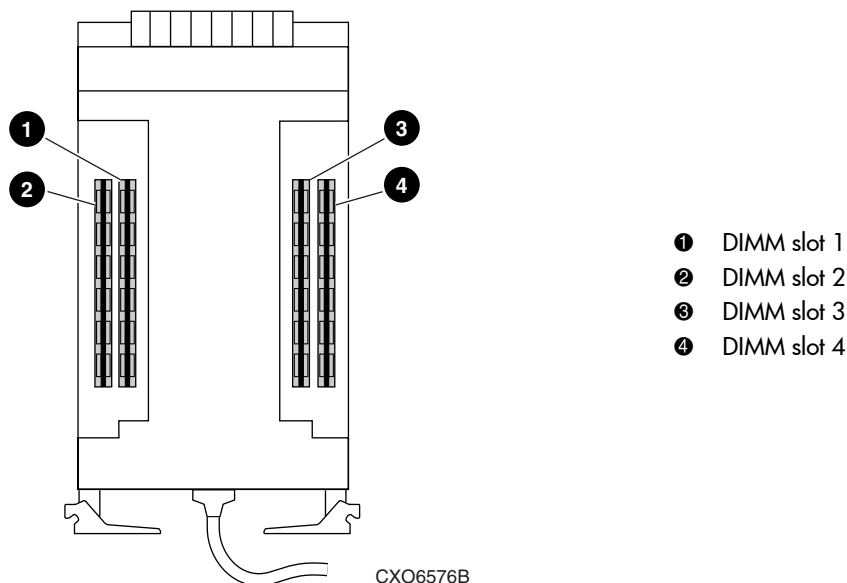


Figure 25: Cache module DIMM locations

Table 8: Cache module memory configurations

Memory	DIMMs	Quantity	Location
128 MB	32 MB	4	1 2 3 4
256 MB	128 MB	2	1 3
512 MB	128 MB	4	1 2 3 4

Note: The cache size requirement for running ACS V8.8-xP or V8.8-xS is 512 MB. For ACS V8.8-xF, V8.8-xG, and V8.8-xL, the minimum cache size requirement is 128 MB in unmirrored configurations and 256 MB in mirrored configurations, per cache module. Failure to upgrade cache memory appropriately can result in an inoperable controller and increase subsystem down-time.



Caution: ESD can easily damage a cache module or a DIMM. Wear a snug-fitting, grounded ESD wrist strap while replacing DIMMs.

Note: If a DIMM fails, note which DIMM needs replacement based on the diagram displayed on the console. ACS displays the following CLI messages if a DIMM failure is detected:

```
1.%CER--DebugTop> --18-MAY-2005 10:50:47-- Cache module
DIMM 2 failed
2.%EVL--DebugTop> --18-MAY-2005 10:50:58-- Instance Code:
02623801 (not yet reported to host)
DIMM      Instance Code
DIMM-1 = 02613801
DIMM-2 = 02623801
DIMM-3 = 02633801
DIMM-4 = 02643801
```

Refer to *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Troubleshooting Guide* for cache policies information that to determine which cache module and DIMM are at fault.

Figure 26 illustrates how to remove and install DIMMs.

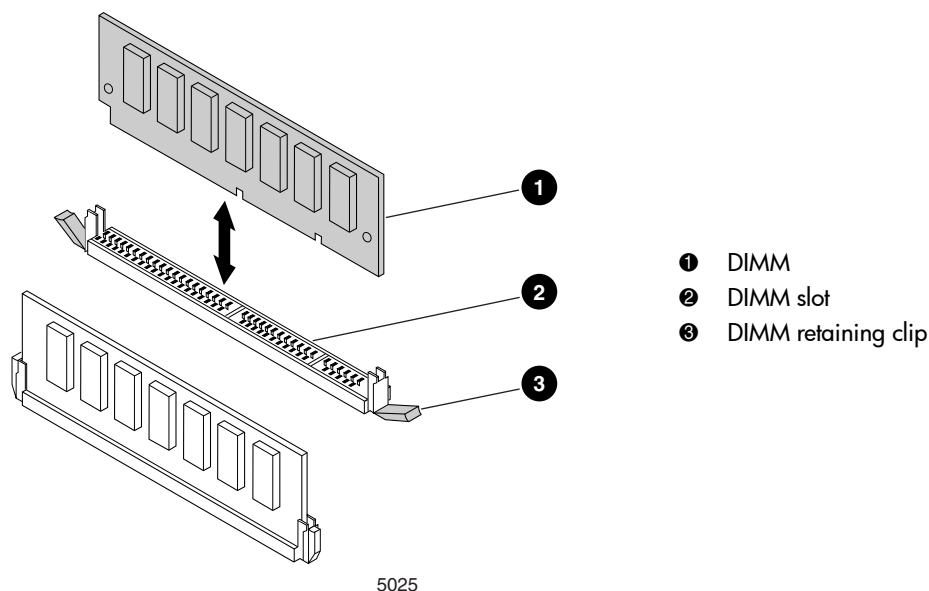


Figure 26: DIMM components

Replacing an HSG60 and HSG80 DIMM in single-controller configurations

Use the steps in “[Removing a GLM](#)” and “[Installing a GLM](#)” to replace DIMMS in a cache module.



Caution: Static electricity can easily damage a cache module or a DIMM. Wear a snug-fitting, grounded electrostatic discharge (ESD) wrist strap.

Removing DIMMs

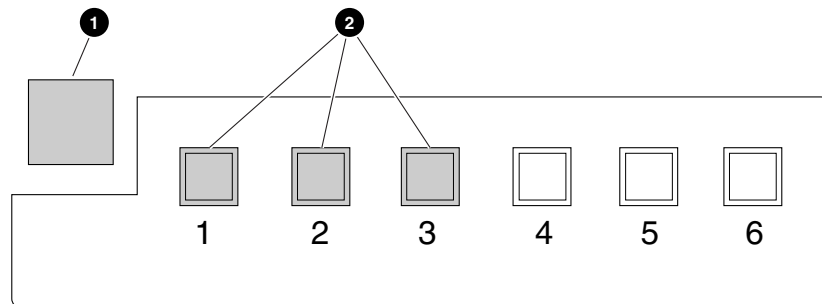
Use the following steps to remove DIMMs from a cache module in single-controller configurations:

1. Determine whether the controller is operational:

- If the controller is operational, connect a PC or terminal to the controller maintenance port.
 - If the controller is not operational, Go to [step 6](#) on page 74.
2. From the host console, stop all host activity to the controller, and then dismount the logical units in the subsystem.
 3. If using a Microsoft® Windows 2000® or Windows NT® platform, shut down the server.
 4. Run the *Fault Management Utility (FMU)* to obtain the last failure codes, if desired.
 5. Shut down “this controller” with the following command:

```
SHUTDOWN THIS_CONTROLLER
```

Note: After the controller shuts down, the **Reset** button and the first three port LEDs turn on (see [Figure 27](#)). This can take several minutes depending on the amount of data that needs to be flushed from the cache module.



CXO6991A

❶ Reset button

❷ First three port LEDs

Figure 27: Controller Reset button and first three port LEDs

Note: For StorageWorks Model 2100 and 2200 enclosures, omit [step 6](#) and [step 7](#) on page 74. The ECB does not contain switches or use ECB Y-cables.



Caution: You must disable the ECB before disconnecting the ECB Y-cable from the cache module. Failure to disable the ECB can damage the cache module.

6. Disable the ECB by pressing in the battery disable switch while removing the ECB Y-cable from the cache module.
 7. Release the battery disable switch.
 8. Disengage both retaining levers, remove the cache module, and then place the cache module on an antistatic bag or a grounded antistatic mat.
-

Note: You must remove the DIMMs for installation in the replacement cache module.

9. Note the location of each DIMM in the old cache module and install the DIMMs in same location of the replacement cache module.
 10. Press down on the DIMM retaining clips (see [Figure 28](#) on page 75) at both ends of the DIMM being removed.
-

Note: To facilitate pressing down on the DIMM retaining clips, use the eraser end of a pencil or a small screwdriver.

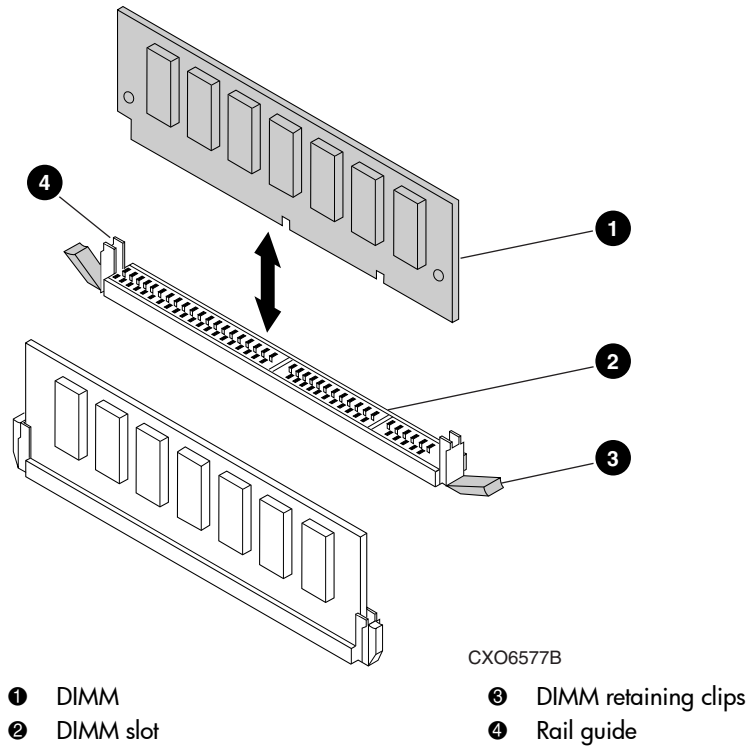


Figure 28: Removing or installing a DIMM

11. Gently remove the DIMM from the DIMM slot, and then place it in an antistatic bag or on a grounded antistatic mat.
12. Repeat [step 10](#) and [step 11](#) for each DIMM being replaced.

Installing DIMMs

Use the following steps to install DIMMs in a cache module in single-controller configurations:

Note: Before installing DIMMs, note the following:

- New cache modules have no DIMMs installed; the DIMMs are packaged separately. Unpack the DIMMs and install them into the cache module as required.
 - Both cache modules *must* contain the same memory configuration for the ACS version. See [Figure 25](#) on page 70 and [Table 8](#) on page 70 on for valid cache module memory configurations.
 - Some HSG80 controller configurations require a 512-MB cache memory configuration. Make sure the cache memory configuration meets or exceeds the ACS requirement. See cache memory configurations on page 70.
-

1. Insert each DIMM (see [Figure 28](#) on page 75) straight into the appropriate slot of the cache module, ensuring that the notches in the DIMM align with the tabs in the slot.
2. Press the DIMM gently into the slot until seated at both ends.
3. Engage the two retaining clips for the DIMM (see [Figure 28](#) on page 75).
4. Make sure both ends of the DIMM are firmly seated in the slot and both retaining clips engage the DIMM.
5. Repeat [step 1](#) through [step 4](#) for each DIMM.
6. Carefully align the cache module in the appropriate guide rails.



Caution: Misalignment can damage the backplane.

7. Insert the cache module into the appropriate bay and engage the retaining levers.

Note: For StorageWorks Model 2100 and 2200 enclosures, omit [step 8](#) and [step 9](#) (on page 77). The ECB does not contain switches or use ECB Y-cables.



Caution: You must disable the ECB before disconnecting the ECB Y-cable from the cache module. Failure to disable the ECB can damage the cache module.

8. If not already done, disable the ECB by pressing the battery disable switch for approximately 5 seconds.
 9. Connect the ECB Y-cable to the cache module.
 10. If not already connected, connect a PC or terminal to the controller maintenance port.
 11. Restart the controller by pressing the **Reset** button.
-

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

Note: If the controller did not restart, use the following steps:

- a. Press and hold the controller **Reset** button.
 - b. Reseat the controller program card.
 - c. Release the **Reset** button.
-

12. From the CLI prompt, display details about the configured controller using the following command:

```
SHOW THIS_CONTROLLER FULL
```

13. Set the date and time by using the following command, if necessary:

```
SET THIS_CONTROLLER TIME=dd-mm-yyyy:hh:mm:ss
```

14. Mount the logical units on the host.
15. For Windows 2000 or Windows NT platform users, restart the server.
16. Disconnect the PC or terminal from the controller maintenance port.

Replacing an HSG60 and HSG80 DIMM in dual-redundant controller configurations

Use the steps in “[Removing a GLM](#)” and “[Installing a GLM](#)” to replace DIMMS in a cache module:

Note: If you are upgrading cache memory, be sure to install a valid memory configuration (see [Figure 25](#) on page 70). Failure to do so results in an inoperable controller and increases subsystem down-time. Both cache modules *must* contain the same memory configuration for the ACS version.



Caution: Static electricity can easily damage a cache module or a DIMM. Wear a snug-fitting, grounded electrostatic discharge (ESD) wrist strap.

Removing DIMMs

Use the following steps to remove DIMMs from a cache module in dual-redundant configurations:

1. Connect a PC or terminal to the maintenance port of the operational controller.

The controller connected to the PC or terminal becomes “this controller”; the controller for the cache module being removed becomes the “other controller.”

2. Disable failover, and then take the controllers out of the dual-redundant configuration with one of the following commands:

```
SET NOFAILOVER
```

or

```
SET NOMULTIBUS_FAILOVER
```

3. Start the *Field Replacement Utility (FRUTIL)* with the following command:

```
RUN FRUTIL
```

4. Enter **N(o)** to the question about replacing the cache battery.
5. Enter **1** to replace or remove a controller or cache module.
6. Enter **3** to replace or remove the “other controller” cache module.

7. Enter **Y**(es) to confirm the intent to remove the “other controller” cache module.
8. Wait for *FRUTIL* to quiesce the device ports—indicated by an “All device ports quiesced” message.



Caution: Failure to allow the ports to quiesce can result in data loss. Quiescing can take several minutes.

The ECB must be disabled before disconnecting the ECB cable from the cache module. Failure to disable the ECB might result in cache module damage.

Note: A countdown timer allows a total of 2 minutes to remove the cache module. After 2 minutes, “this controller” exits *FRUTIL* and resumes operations. If this happens, return to [step 3](#) on page 78 and proceed.

9. For StorageWorks Model 2100 and 2200 enclosures, disengage both retaining levers and remove the “other controller” cache module.
10. For all other supported enclosures:
 - a. Disengage both retaining levers and partially remove the “other controller” cache module—about halfway.



Caution: You must disable the ECB before disconnecting the ECB Y-cable from the cache module. Failure to disable the ECB might damage the cache module.

- b. Disable the ECB by pressing in the battery disable switch while removing the ECB Y-cable from the cache module.
 - c. Release the battery disable switch.
 - d. Disconnect the ECB cable from the “other controller” cache module.
 - e. Remove the cache module from the enclosure.
11. Place the cache module on an antistatic bag or a grounded antistatic mat.
12. Enter **N**(o) to the question for a replacement cache module.

FRUTIL exits.

13. Press down on the DIMM retaining clips at both ends of the DIMM being removed (see [Figure 28](#) on page 75).

Note: To facilitate pressing down on the DIMM retaining clips, use the eraser end of a pencil or a small screwdriver.

14. Gently remove the DIMM from the DIMM slot, and then place it in an antistatic bag or on a grounded antistatic mat.
15. Repeat [step 13](#) and [step 14](#) for each DIMM being replaced.

Installing DIMMs

Use the following steps to install DIMMs in a cache module in dual-redundant configurations:

Note: Before installing DIMMs, note the following:

- New cache modules arrive without DIMMs installed; the DIMMs are packaged separately. Unpack the DIMMs and install them into the cache module as required.
 - Both cache modules *must* contain the same memory configuration for the ACS version. See page 70 for valid cache module memory configurations.
 - Some HSG80 controller configurations require a 512-MB cache memory configuration. Make sure the cache memory configuration meets or exceeds the ACS requirement. See “Cache memory configuration” on page 2.
-

1. Insert each DIMM (see [Figure 28](#) on page 75) straight into the appropriate slot of the cache module, ensuring that the notches in the DIMM align with the tabs in the slot.
2. Press the DIMM gently into the slot until seated at both ends.
3. Engage the two retaining clips for the DIMM (see [Figure 28](#) on page 75).
4. Make sure both ends of the DIMM are firmly seated in the slot and both retaining clips engage the DIMM.
5. Repeat [step 1](#) through [step 4](#) for each DIMM.
6. If not already connected, connect a PC or terminal to the operational controller.

The controller connected to the PC or terminal becomes “this controller”; the controller for the cache module being installed becomes the “other controller.”

7. Start *FRUTIL* with the following command:

```
RUN FRUTIL
```

8. Enter **N(o)** to the question about replacing the cache battery.
9. Enter **2** for the install a controller or cache module option.
10. Enter **3** for the install the “other controller” cache module option.
11. Enter **Y(es)** to confirm the intent to install the “other controller” cache module.
12. Wait for *FRUTIL* to quiesce the device ports—indicated by an “All device ports quiesced” message.



Caution: Failure to allow the ports to quiesce can result in data loss. Quiescing can take several minutes.

You must disable the ECB before connecting the ECB cable to the cache module. Failure to disable the ECB might damage the cache module.

Carefully align the cache module in the appropriate guide rails. Misalignment might damage the backplane.

Note: A countdown timer allows a total of 2 minutes to install the cache module. After 2 minutes, “this controller” exits *FRUTIL* and resumes operations. If this happens, return to [step 7](#) and proceed.

13. Follow on-screen instructions to install the cache module and to restart the “other controller.”

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

Note: If the “other controller” did not restart:

- a. Press and hold the “other controller” **Reset** button.
 - b. Reseat the “other controller” program card.
 - c. Release the **Reset** button.
-

Tip: To verify that the “other controller” restarts, connect a PC or terminal to the maintenance port, and then verify that it passed the cache diagnostic test.



Caution: In [step 14](#), entering the appropriate `SET` command is critical. Enabling an incorrect Failover mode can cause loss of data and incur system down time.

Verify the original failover configuration and use the appropriate `SET` command to restore this configuration.

14. Enable failover and reestablish the dual-redundant configuration with the following command:

```
SET FAILOVER COPY=THIS_CONTROLLER
```

or

```
SET MULTIBUS_FAILOVER COPY=THIS_CONTROLLER
```

This command copies the subsystem configuration from “this controller” to the “other controller.”

15. If desired, verify the failover configuration with the following command:

```
SHOW THIS_CONTROLLER FULL
```

16. Disconnect the PC or terminal from the controller maintenance port.

Handling storagesets, mirrorsets, stripesets, RAIDsets and JBODs

The following subsections provide information on handling complex storageset, mirrorset, stripeset, RAIDset and JBOD issues.

Replacing failed storageset members

If a disk drive fails in a RAIDset or mirrorset, array controllers automatically place the disk drive into the failedset. If the spareset contains a replacement disk drive that satisfies the storageset replacement policy, the array controllers automatically replace the failed member with the replacement disk drive. If the spareset is empty or does not contain a satisfactory disk drive, the array controllers simply *reduce* the storageset so that the storageset can operate without one of the members. The storageset remains in this *reduced* state until the spareset contains a satisfactory disk drive. If the array controllers sense a satisfactory disk drive in the spareset, the array controllers automatically place the disk drive into the storageset and restores the storageset to normal. Therefore, *replacing a failed storageset member means putting a satisfactory disk drive into the spareset.*

Note: For supported replacement procedures, see the “[Replacing a disk drive](#)” section that starts on page 94.

Note: Depending on the system load and the number of drives installed, you may need to wait 1 to 5 minutes between the removal and installation of a replacement disk in order for the replacement procedure to complete properly.

Tip: With ACS 8.8-*x*, all disk drives with model numbers beginning with *B* (for example, *B00721937*) use auto-read-reallocate (ARRE) functionality. ARRE allows drives to resolve recoverable errors and properly handle block replacements.

Removing a failed RAIDset or mirrorset member

Use the following guidelines when replacing disk drives:

- Never remove more than one disk drive at a time.

If a disk drive is replaced, array controllers use data from the other disk drives in the array to reconstruct data on the replacement disk drive. If more than one disk drive is removed, a complete data set is not available to reconstruct data on the replacement disk drives, and permanent data loss may occur.

- Never remove a disk drive while another disk drive in the same storage array is being rebuilt.

Disk drive Online LED Indicators flash green while it is being rebuilt. A replaced disk drive is rebuilt from data stored on the other disk drives.

- Never turn a disk enclosure off while the initiator or array controllers are powered on or active.



Caution: Turning a disk enclosure off while the initiator or array controllers are powered on or active can cause the initiator or array controller to mark the disk drives as *failed*. This may result in permanent data loss.

- If a disk drive is replaced while the system is off, it may be necessary to rebuild the replaced disk drive.

Follow the instructions on the screen or those outlined in the system reference guide to remove a failed disk drive. Use the following steps to remove a failed RAIDset or mirrorset member:

1. Connect a PC or terminal to the array controller maintenance port that accesses the reduced RAIDset or mirrorset.
2. Enter the following command:

```
SET FAILEDSET AUTOSPARE
```

With *AUTOSPARE* enabled, any new disk or disk drive—one that has not been in an array before—inserted into the port-target-LUN (PTL) location of a failed disk drive is automatically initialized and placed into the spareset.

3. Remove the failed disk drive.

Installing a new RAIDset or mirrorset member

To install a new RAIDset or mirrorset member, insert a new disk drive that satisfies the replacement policy of the reduced storageset into the PTL location of the failed disk drive.

Note: HSG60 and HSG80 array controllers automatically initialize a new disk drive and place this disk drive into the spareset if the *AUTOSPARE* switch is enabled. (By default, array controllers are set to *NOAUTOSPARE*.) As soon as the disk drive becomes a member of the spareset, array controllers automatically use the disk drive to restore the reduced RAIDset or mirrorset. If initialization of the new disk drive fails, the disk drive is placed into the failedset.

Tip: Depending on the system load and the number of drives installed, you may need to wait 1 to 5 minutes between the removal and installation of a replacement disk in order for the replacement procedure to complete properly.

Moving a reduced RAIDset across subsystems

If you move a RAIDset to another subsystem and back to the original subsystem, and the RAIDset is reduced somehow during transition, create a RAIDset with members of the normal RAIDset as well as a newly initialized disk. Doing this allows you to mount the RAIDset back into its original controller. The following steps outline how to correctly move a RAIDset in this manner.

1. Verify which RAIDset is to be moved (see [Figure 29](#)).

```
g_top> show r5
Name      Storageset              Uses              Used by
-----
R5        raidset                   DISK21200         D5
                                     DISK21300
                                     DISK21400
                                     DISK21500

Switches:
POLICY (for replacement) = BEST_PERFORMANCE
RECONSTRUCT (priority) = NORMAL
CHUNKSIZE = 256 blocks

State:
NORMAL
DISK21200 (member 0) is NORMAL
DISK21300 (member 1) is NORMAL
DISK21400 (member 2) is NORMAL
DISK21500 (member 3) is NORMAL
Size:     106643109 blocks
```

Figure 29: Display showing the RAIDset to be moved.

2. Delete the RAIDset on “this controller” (see [Figure 30](#)).

```
g_top> del d5
g_top> del r5
g_top> del disk21200
g_top> del disk21300
g_top> del disk21400
g_top> del disk21500
```

Figure 30: Deleting the RAIDset on the originating subsystem

3. Add the RAIDset on the “other controller” (see [Figure 31](#)).

```
zBot> add disk disk20400 2 4 0
zBot> add disk disk50300 5 3 0
zBot> add disk disk60200 6 2 0
zBot> add disk disk10300 1 3 0
zBot> init disk10300
```

3 Members of the original RAIDset

New disk that is not a member

Figure 31: Adding the RAIDset to the “other controller” and adding a new disk

4. Add the new disk, initialize it (see [Figure 31](#)), and then issue the SHOW command (see [Figure 32](#)).

Note: Do not initialize the original members or the RAIDset.

```
zBot> show disk10300
```

Name	Type	Port	Targ	Lun	Used by
DISK10300	disk	1	3	0	
	COMPAQ	BF00963643	3B05		
Switches:					
NOTTRANSPORTABLE					
TRANSFER_RATE_REQUESTED = 20MHZ (synchronous 20.00 MHZ negotiated)					
Size: 17769177 blocks					

Figure 32: Submitting the SHOW command

5. Add the RAIDset and member ($n-1$) with a new initialized disk on the “other controller.”

```
zBot> add raidset r5 disk10300 disk20400 disk50300 disk60200
zBot> add unit d5 r5
```

Figure 33: Adding the RAIDsets and new member

The screen shown in [Figure 34](#) on page 88 is displayed. In [Figure 34](#), Instance Code 02675201 indicates that the member moved to the failedset.

```
%EVL--zTop> --28-JAN-2004 16:35:39-- Instance Code: 02675201

< The device specified in the Device Locator field has been removed from the
RAIDset associated with the logical unit. The removed device is now in the
Failedset. The RAIDset is now in Reduced state. >

Template: 81.(51)
Occurred on 28-JAN-2004 at 16:35:39
Power On Time: 0. Years, 340. Days, 21. Hours, 31. Minutes, 40. Seconds
Controller Model: HSG80
Serial Number: ZG04808673 Hardware Version: 0000(00)
Software Version: V88P-0(FF)
Unit Number: 5.(0005)
Unit Software Version: 1.(01) Unit Hardware Version: 53.(35)
Retry Level: 1. Retries: 1.
Port: 1. Target: 3. LUN: 0.
SCSI Device Type: 0.(00)
Device ID: "BF00963643" Device Serial Number: "71355BKD"
Device Software Revision Level: "3B05"
SCSI Command Opcode: 0.(00)
Sense Data Qualifiers: 0.(00)
SCSI Sense Data:
  Error Code: 112.(70) {current command execution}
  Information field is valid
  Segment: 0.(00)
  Sense Key: 6.(06) UNIT ATTENTION
  ILI: 0 EOM: 0 FM: 0
  Information: 00000000
  Additional Sense Length: 0.(00)
  Command-Specific Information: 00000000
  ASC: 160.(A0) ASCQ: 7.(07)
  FRU: 0.(00) Sense-Key Specific: 000000
Instance Code: 02675201
```

Figure 34: Display indicating that the RAIDset is moved to another location

6. Verify that the RAIDset is moved and configured correctly, and that the one disk is moved to the failedset.

```
zBot> show r5
```

Name	Storageset	Uses	Used by
R5	raidset	DISK20400 DISK50300 DISK60200	D5

```
Switches:
```

```
POLICY (for replacement) = BEST_PERFORMANCE
```

```
RECONSTRUCT (priority) = NORMAL
```

```
CHUNKSIZE = 256 blocks
```

```
State:
```

```
REDUCED
```

```
DISK60200 (member 1) is NORMAL
```

```
DISK20400 (member 2) is NORMAL
```

```
DISK50300 (member 3) is NORMAL
```

```
Size: 106643109 blocks
```

Figure 35: Display showing the configured RAIDset

[Figure 37](#) on page 90 displays the disk that is moved to the failedset.

```
zBot> show d5
```

LUN	Uses	Used by
D5	R5	
LUN ID: 6000-1FE1-0007-A220-0009-1040-2700-00A9		
IDENTIFIER = 5		
Switches:		
RUN	NOWRITE_PROTECT	READ_CACHE
READAHEAD_CACHE	WRITEBACK_CACHE	
MAX_READ_CACHED_TRANSFER_SIZE = 32		
MAX_WRITE_CACHED_TRANSFER_SIZE = 32		
Access:		
ALL		
State:		
ONLINE to this controller		
Not reserved		
NOPREFERRED_PATH		
Size: 106643109 blocks		
Geometry (C/H/S): (20993 / 20 / 254)		

Figure 36: Display showing unit

```
zBot> show disk10300
```

Name	Type	Port	Targ	Lun	Used by
DISK10300	disk	1	3	0	FAILEDSET
COMPAQ	BF00963643	3B05			
Switches:					
NOTTRANSPORTABLE					
TRANSFER_RATE_REQUESTED = 20MHZ (synchronous 20.00 MHZ negotiated)					
Size: 17769177 blocks					

Figure 37: Display showing the moved disk (not a member of the original RAIDset) as part of the failedset

7. Delete the failedset, and then place the disk of choice into the RAIDset so that the unit can be Normalized:

```
zBot> delete FAILDSET disk10300
```

Moving storage sets

Move storage sets that are in Normal mode only. Never move storage sets that are *reconstructing* (content regeneration after a failed disk to a spare) or were *reduced* (missing member from a mirrorset or RAIDset).



Caution: Ensure all storage sets are in Normal mode prior to moving them or data corruption occurs. Also, ensure that data is flushed from cache on the units (that is, unmount the devices from the host operating system, and delete the units before shutting the storage system).

Replacing a failed JBOD

Use the following steps to remove a failed JBOD:

1. Back up the data on the JBOD.
2. Dismount the disk from the host system.
3. Delete the unit with the following command:

```
DELETE UNIT DXXX
```
4. Delete the disk with the following command:

```
DELETE DISKXXXX
```
5. Quiesce the bus.
6. Replace the failed disk with a new disk that is the same size or larger.

7. Add a new disk to the array controller configuration with one of the following commands:

```
ADD DISKS DISKXXXX P T L
```

or

```
RUN CONFIG
```

Note: If you submit the `RUN CONFIG` CLI command when a bad disk drive exists, ACS skips the bad disk drive while running the `RUN CONFIG` command and reports the following error:

```
DEVICE AT P1:T4:L0 failed initialization, Skipping  
Device
```

8. Add a unit with the following command:

```
ADD UNITS DXXX DISKXXXX
```

9. Mount the disk to the operating system.

10. Restore the data from the backup.

Tip: Depending on the system load and the number of drives installed, you may need to wait 1 to 5 minutes between the removal and installation of a replacement disk in order for the replacement procedure to complete properly.

Tip: If at any time, disk drive errors occur and you must contact an HP service representative, submit the `SHOW DEVICE_ERRORS FMU` command prior to contacting an HP service representative. Submitting the `SHOW DEVICE_ERRORS FMU` command generates a report that assists the HP service representative in resolving device problems. For additional details regarding the `SHOW DEVICE_ERRORS` command, refer to the *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Troubleshooting Guide*.

Replacing a storage unit with partitions

Storage containers that have partitions created on them present a unique maintenance issue in that the partition may reside on one disk (JBOD) or across several disks (RAID0, RAID 0+1, RAID5). Failure of any partition can require

the replacement (backup and restore) of the data contained in all partitions on that device. This is particularly true of a partitioned JBOD and stripeset. Use great care if you are planning the use of partitions for anything other than temporary data storage.

Replacing a disk drive

Disk drive hot swapping is supported under the circumstances described below. Abide by the following rules related to disk drive removal and disk drive insertion into HSG80 subsystems.

Note: If you submit the `RUN CONFIG CLI` command while a bad disk drive exists, ACS skips the bad disk drive while running the `RUN CONFIG` command and reports the following error:

```
DEVICE AT P1:T4:L0 failed initialization, Skipping
Device
```

Tip: Consider the following initialization and troubleshooting tips:

- If you are initializing a disk, HP recommends that you initialize the disk without any partitions prior to initially placing it into use. If you are adding a new disk to an array, and it is presented to a Microsoft Windows or Windows NT host, add the new disk to the array first, and then initialize the disk using the `INITIALIZE container-name DESTROY_MBR` CLI command. Doing this prevents the creation of more than one partition on a disk. Refer to the *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Command Line Interface Reference Guide* for additional information about the `INIT DEVIC DESTROY_MBR` CLI command.
- If you have a disk that was initialized at the container or device level using the `SAVE_CONFIGURATION` switch, you can submit the `ASSIGN storageset LUN_WWID=xx` CLI command to remove the `SAVE_CONFIGURATION` attribute and reassign the unit its original WWID.
- If you need specific information regarding disks in a subsystem, you can submit the `SHOW DEVICE_INFO ALL` or `SHOW DEVICE_INFO Dxxxxx FMU` command. This command provides details regarding the disk port number, target number, model number, firmware version, serial number, device flags, metadata version, and `SAVE_CONFIGURATION` status. Refer to the *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Troubleshooting Guide* for additional information about the `SHOW DEVICE_INFO ALL` and `SHOW DEVICE_INFO Dxxxxx FMU` commands.

- If at any time, disk drive errors occur and you must contact an HP service representative, submit the `SHOW DEVICE_ERRORS FMU` command prior to contacting an HP service representative. Submitting the `SHOW DEVICE_ERRORS FMU` command generates a report that assists the HP service representative in resolving device problems. For additional details regarding the `SHOW DEVICE_ERRORS` command, refer to the *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Troubleshooting Guide*.
-

Removing and replacing all disk drives

In all cases (disk drive hot or warm swapping), you must remove the required disk drive from any unit association and storagesets, including mirrorset, failedset, or spareset prior to initiating the physical removal. Use the following commands to complete this action:

```
HSG prompt> DELETE unit-name or reduce the storageset member (mirrorset or RAID 3/5)
```

```
HSG prompt> DELETE storageset-name or SET mirrorset-name REMOVE=disknnnnn
```

```
HSG prompt> DELETE disknnnnn;
```

Adding, moving, and changing disk drives

The array controller maintains a configuration map of device types and locations. This map is used to communicate with devices. If you add, move, or change a device while the array controller is powered off, without first changing the array controller configuration, the array controller cannot communicate with the changed device after its returned to service.

If you remove a disk drive while the array controller is off, delete all containers associated with the removed disk drive after power is restored to the array controller. If you have difficulty removing the disks or containers from the configuration after you restore power, because of cache lost data, power down the storage subsystem again, remove the power from the cache module (pulling it out of the backplane of the EMA or MA series enclosure or removing the cache battery cable to the front of the cache module on RA8000 enclosures), and then power up and clear the lost data indications.

If a disk drive is *replaced* after the array controller is off, install the replacement disk drive before restoring power to the array controller. After the power is restored, use the `DELETE container-name` CLI command to remove the disk from the configuration. Then, use the `ADD DISKS` CLI command to add the new disk drive.

Disk drive hot swap support

Disk drive hot swapping is supported *only* if the following conditions are met:

- Array controllers are not engaged in Failover or Failback.
- Array controllers are not running a local utilities such as *DILX* or *VTDPY*.
- The array controller CLI prompt is accessible (not while a previous CLI command is being processed).
- If the disk drive being removed or replaced is physically moved to a new port or target location on the same array controller, you must wait a minimum of 60 seconds before re-inserting device into its new location.
- If the array controller is in the process of recognizing or processing one or more hot disk drive insertions, the array controller must be allocated enough time to do proper device discovery for both operations. The busier the array controller, the longer the waiting time should be. (One disk drive at a time—waiting 60 seconds between physical removal or replacement operations).
- Do not remove a device from a unit that is under load (including reconstruction and initialization). If you want to remove a device from a unit, you must reduce the RAIDset or mirrorset and delete the *diskxxxxxx* device.

Disk drive warm swap support

Disk drive warm swapping is supported under the circumstances described below. Abide by the following rules related to disk drive removal and disk drive insertion into HSG60 or HSG80 subsystems. Promptly execute the procedure so that the internal detect *swap signal* terminates the quiesce functionality.

Disk drive warm swap

If disk drive hot swapping is not applicable, use disk drive warm swapping. Also, from a data integrity perspective, the best method of physically removing a device in a parallel bus multi-drop architecture (such as a SCSI bus) is to use a warm

swap process. This involves quiescing the device bus for the device to be removed and replaced. This activity provides a momentary stall on that bus, while work continues on the adjacent bus.

Using the following steps to complete a warm swap:

1. Press the appropriate port button on the array controller front panel until the I/O quiesces on the bus.
2. Remove the disk drive.
3. Repeat the above steps to replace a disk drive.

Procedural example of a warm swap

This example shows how to select a device in a storageset, and take the appropriate measures to remove the physical device from the subsystem.

CLI Commands to HSG80 or Actions	Comments
<pre>HSG80>SHOW diskxxxxxx</pre> <pre>HSG80> LOCATE diskxxxxxx</pre>	<p>Verify that the disk drive (<i>diskxxxxxx</i>) is not a member of a storageset such as RAID1, RAID0, RAID 0+1, RAID 3/5.</p> <p>Verify physical location of disk drive. You can put a physical mark on the disk drive.</p>
<pre>HSG80> LOCATE CANCEL</pre>	<p>Verify that the disk drive amber light turns off.</p>
<p>On a HSG80 controller, press the port button of the physical port containing the disk drive to be removed.</p>	<p>Press the Port #1 button for about 2 seconds and then release it. After the HSG80 array controller recognizes the action, all the port lights on the HSG80 array controller bulkhead flash on for about 1 second. The port light on the HSG80 array controller begins to pulse.</p> <hr/> <p>Note: Remember to press the correct port button.</p> <hr/>

CLI Commands to HSG80 or Actions	Comments
Wait for Port to quiesce.	<p>Go to the side of cab from where you remove the disk drive and wait approximately 10-15 seconds. The port is quiesced, when <i>all</i> the disk drives on that port show a flashing amber LED.</p> <hr/> <p>Note: If the disk drive on that port has the locate light function enabled, the disk drive LED for that device is solid until the quiesce sequence is over, at which time it begins to flash and the other devices stops flashing.</p> <hr/>
Promptly - physically remove disk drive about 2.54 cm (1-in) out, then give disk drive time to spin-down (60 seconds). Complete removal process.	Both array controllers port lights remain solid and the disk drive lights goes off. Within about 20 seconds of device removal, device activity begins to resume on the remaining units. The period of time is load dependent.
Installing disk drive into slot.	Verify that 2 minutes have passed since disk drive removal installation.
On the HSG80 controller, press the port button of the physical port containing the disk drive to be removed.	<p>Press the port button for about 2 seconds and then release. When the action is recognized by the HSG80 array controller, all the port lights on the HSG80 array controller bulkhead flashes on for about 1 second. Then, the port light on the HSG80 array controller begins to pulse.</p> <hr/> <p>Note: Remember to press the correct port button.</p> <hr/>
Wait for Port to quiesce.	Go to the side of cab from where you remove the disk drive and wait approximately 10-15 seconds. The port is quiesced when <i>all</i> the disk drives on that port have a flashing amber LED.
Physically push disk drive into the shelf.	Within about 20 seconds of device insertion, the device activity to other storage resumes. Both array controller port lights turn off and the disk drive lights go off (if no disk drive faults on that port).

Disk drive auto-read-reallocate bit activation

Select disk drives use an auto-read-reallocate (ARRE) function that allows drives to resolve recoverable errors. All disk drives with a model number beginning with *B* (for example, B00721937) implement ARRE functionality.

Replacing BA370, M2100 & M2200 Enclosure Elements

3

This chapter describes the following topics:

- [Shutting down the subsystem](#), page 102
- [Restarting the subsystem](#), page 105
- [Replacing array controllers and cache modules](#), page 107
- [Replacing an ECB](#), page 149
- [Replacing a PVA module](#), page 158
- [Replacing an I/O module](#), page 161
- [Handling a failed DIMM](#), page 165

Refer to your enclosure documentation for information about replacing power supplies, power cables, AC input boxes, cooling fans, and bus cables.



Caution: See the “[Prerequisites](#)” section that starts on page 14 and the “[Common Replacement Information and Procedures](#)” chapter that starts on page 45 to review the list of required tools and the precautions to follow prior to performing procedures within this chapter.

Shutting down the subsystem

Use the following steps to shut down a subsystem:

1. Connect a PC or terminal to the maintenance port of one of the subsystem array controllers.
2. From a host console, stop all host activity to the array controllers and dismount the logical units in the subsystem.
3. If you are using a Windows NT or Windows 2000 platform, shut down the server.
4. Shut down the array controllers:

- In single-controller configurations, shut down “this controller” with the following command:

```
SHUTDOWN THIS_CONTROLLER
```

- In dual-redundant controller configurations, shut down the “other controller” first, then shut down “this controller” with the following commands:

```
SHUTDOWN OTHER_CONTROLLER
SHUTDOWN THIS_CONTROLLER
```

Note: After the array controllers shut down, the **Reset** buttons and the first three LEDs on the OCP turn on (see [Figure 38](#)). This process takes several minutes, depending on the amount of data that needs to be flushed from the cache modules.

5. Proceed only after the **Reset** buttons and the first three LEDs stop flashing and remain solid.

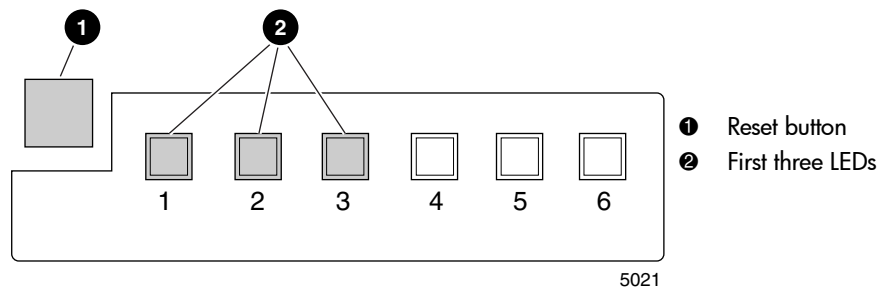


Figure 38: OCP Reset button and first three LEDs

6. Remove power to the subsystem.



Caution: After shutting down an array controller in a BA370 enclosure for longer than one day, perform the steps in the next section, "[Disabling the external cache batteries \(BA370 enclosures only\)](#)" to prevent these write-back cache batteries from discharging.



Caution: After shutting down array controllers in M2200 enclosures for longer than one day, reseal each ECB to stop the ECB fault LED from flashing and prevent the ECB battery from discharging.

Disabling the external cache batteries (BA370 enclosures only)

Use the following steps to disable the ECBs in BA370 enclosures:

Note: An ECB can contain one or two batteries, depending on the configuration (single ECB or dual ECB).

1. Press and hold the battery disable switch (labeled *Shut off*, see [Figure 39](#) on page 104) on the ECB for approximately 5 seconds.

The ECB status LED flashes once, and then turns off.

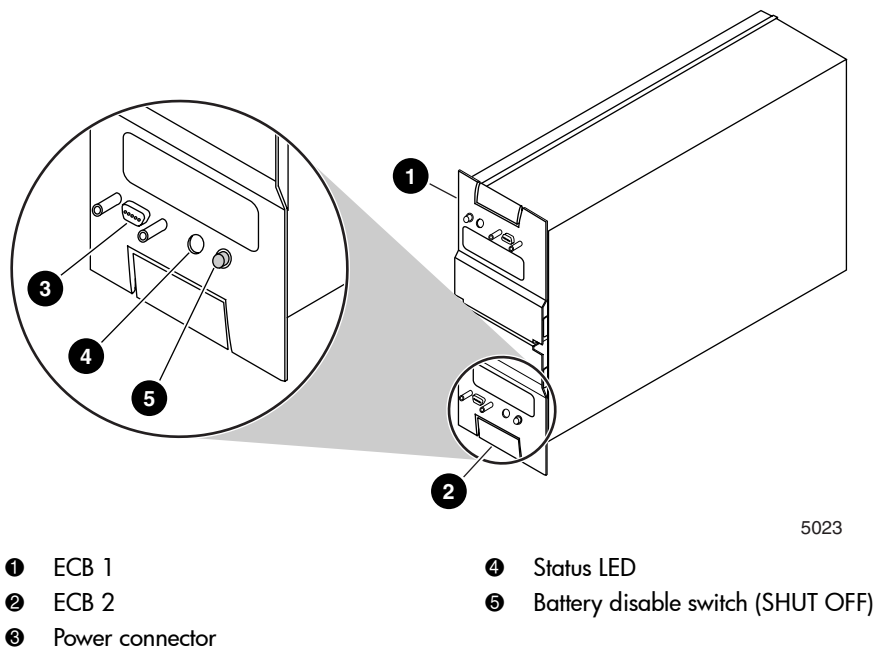


Figure 39: ECB battery disable switch location (dual ECB example)

2. Repeat [step 1](#) on page 103 for all ECBs in the subsystem.

Note: The batteries are no longer protecting the cache module memory.

Enabling the external cache batteries (BA370 enclosures only)

To return the subsystem to normal operation, power on the subsystem. The ECB is enabled when the subsystem is powered on.

Restarting the subsystem

If you need to restart a subsystem, refer to your enclosure documentation for specific procedures for restarting the subsystem.

Note: Powering on the subsystem automatically starts the array controller and turns on the ECBs. An array controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

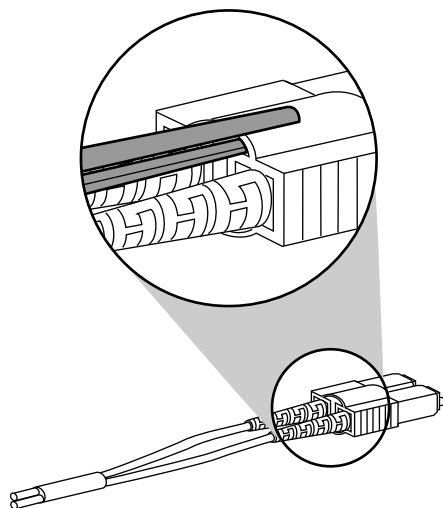
If the array controller does not restart, use the following steps:

1. Press and hold the array controller **Reset** button.
2. Reseat the array controller program card.
3. Release the **Reset** button.
4. Mount the logical units on the host.
5. If using a Windows NT or Windows 2000 platform, restart the server.



Caution: Observe the following precautions:

- In a single-controller configuration, always shut down the subsystem before removing or replacing any modules. Otherwise, data loss can occur.
 - For fiber optic cables without extender clips, use thin needle-nose pliers to remove the cable from the array controller to potentially prevent damaging the cable (see [Figure 40](#) on page 106).
-



5022

Figure 40: Using thin needle-nose pliers to disconnect a fiber optic cable

Note: For single-controller configurations, the only supported array controller and cache module bays are controller A and Cache A. For array controllers in a M2200 enclosure, do *not* use controller B and Cache B bays instead of controller A and Cache A bays.

Replacing array controllers and cache modules

The following subsections provide information on the following:

- [Special considerations and prerequisites](#), page 107
- [Replacing array controllers in a single-controller configurations](#), page 112
- [Replacing array controllers in dual-redundant configurations](#), page 119
- [Replacing cache modules in single-controller configurations](#), page 132

Special considerations and prerequisites

The following special considerations and prerequisites are covered in this section.

- [Replacement controller configuration and cache module prerequisites](#), page 107
- [Special considerations for replacing array controllers in DRM configurations](#), page 108
- [Replacing a controller with an unknown status](#), page 110
- [Replacing a controller with a known status](#), page 112



Caution: Before you replace an array controller or cache module, review the special considerations and prerequisites in this section before beginning the replacement process. Failure to fully review and follow applicable instructions can result in damage to your equipment.

Replacement controller configuration and cache module prerequisites

Note the following prerequisites before starting replacement procedures:

- **Hardware Compatibility**—The replacement controller hardware *must* be compatible with the remaining controller hardware. Refer to product-specific release notes and documentation for information regarding hardware compatibility. Refer also to the HP storage website at: <http://h18006.www1.hp.com/products/storageworks/acs/index.html>.
- **Software Compatibility**—The software versions and patch levels of the replacement controller *must* be the same as that of the operational controller or the controller being replaced.

- **Cache Module Memory Configuration**—The replacement cache module normally uses DIMMs from the cache module being replaced. When replacing DIMMs, you *must* install DIMMs in the replacement cache module in same position as they were in the cache module that is being replaced.
- **Facility Baud Rate**—Record the baud rate of the operational controller.



Caution: Failure to use a factory-fresh configured controller or one that is reset with the **Port #5** button reset action can cause cache corruption on the replacement controller mirrored cache.

- **Storage Building Blocks**—You can replace the controller, cache module, or external cache battery (ECB) storage building block (SBB) while the storage system is shut down by taking the following actions. First, issue the `SET NOFAILOVER` CLI command from the operational controller. This takes the units and moves them from the controller that is to be replaced to the operational controller. Second, shut down the controller to be replaced by entering the `SHUTDOWN THIS_CONTROLLER` CLI command from each controller prior to shutting down the controller. These commands instruct the array controllers to flush all unwritten data from the cache modules and discontinue all I/O activity.

Special considerations for replacing array controllers in DRM configurations

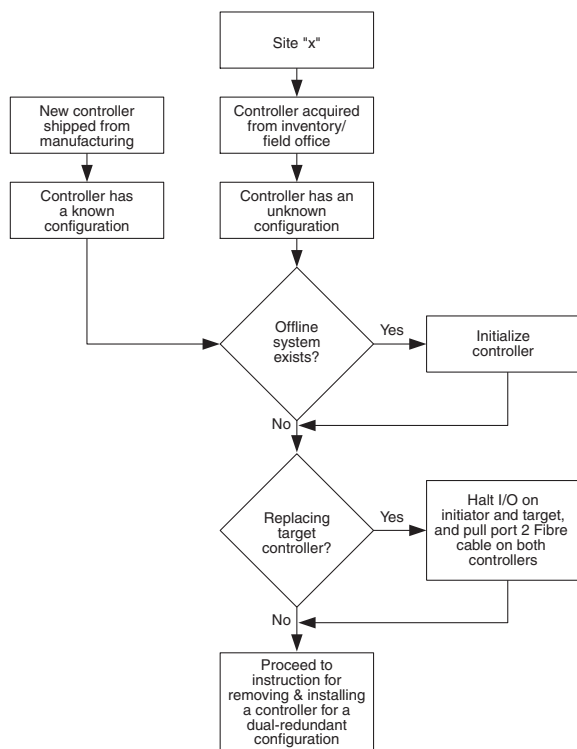
Perform the procedure in the following subsections if a controller in Data Replication Manager (DRM) configuration needs to be replaced.

Note: If you are using ACS V8.8P with DRM, *FRUTIL* cannot be run in remote copy set environments on the target side specifically when I/O is in progress (including normalization I/O). If the host load is stopped, you can run *FRUTIL* on the initiator or target. If the host load is not quiesced and *FRUTIL* is run while remote copy I/O is running, the normalization process is reset.

Figure 41 provides a graphical illustration of the controller replacement process for DRM configurations.



Caution: In DRM configurations, use a factory-provided controller (configuration-free) or one that is reset with the **Port #5** button reset action to avoid mirrored cache corruption on the replacement controller or recursive bugchecks (OCP code 25) on both initiator controllers.



CX06262

Figure 41: Controller replacement process for DRM configurations

Note: Pulling Port #2 Fibre cable on the initiator controller inhibits the chance of invalid cache conditions at the initiator site during target controller replacement actions.

Replacing a controller with an unknown status

Perform the following procedures to initialize your controller configuration if you are unsure¹ of your replacement controller configuration:

1. Determine whether you have an offline or non-DRM-configured subsystem, and then complete one of the following options:
 - Complete the following substeps if you have an offline or non-DRM-configured subsystem:
 - a. Remove a controller from the non-DRM-configured subsystem by completing the instructions in the “[Removing array controllers in dual-redundant controller configurations](#)” section which starts on page 121.
 - b. Complete [step 1](#) through [step 4](#) of the “[Installing array controllers in dual-redundant controller configurations](#)” section (which starts on page 126) to initialize the replacement controller in the non-DRM-configured subsystem.

The replacement controller is initialized with no configuration.
 - c. Remove the replacement controller from the non-DRM-configured subsystem.
 - d. Reinsert the controller that was removed in [substep a](#) above, and complete [step 5](#) through [step 8](#) (see page 131) in the “[Installing array controllers in dual-redundant controller configurations](#)” section.
 - Complete the following substeps if you do *not* have an offline or non-DRM-configured subsystem:
 - a. Halt all I/O on the initiator and target sites of the DRM configuration.
 - b. Disconnect the host port Fibre cables from the controller being replaced.
 - c. Remove a controller by completing the instructions in the “[Removing array controllers in dual-redundant controller configurations](#)” section which starts on page 121.

1. An *unknown* controller is defined as a controller that is a) not a factory-fresh module, b) a controller that was in a system that was using a different ACS version than the system into you are installing the controller or c) a controller with a broken seal with unknown history.

- d. Initialize and install the new controller by completing the instructions in the “[Installing array controllers in dual-redundant controller configurations](#)” section (which starts on page 126).
- e. Reconnect the host port Fibre cables to all of the DRM controllers (initiator and target).
- f. Remount any units that were dismounted.
- g. Start all jobs that were halted in [substep a](#) on page 110.

Replacing a controller with a known status

Perform the following procedures if the configuration of the replacement controller is known:

- Determine whether the controller to be replaced is a target controller, and then complete one of the following options:
 - If the controller to be replaced is *not* a target controller, proceed to the [“Replacing array controllers in dual-redundant configurations”](#) which starts on page 119.
 - If the controller to be replaced is a target controller, complete the following substeps:
 - a. Halt all I/O on the initiator and target sites of the DRM configuration.
 - b. Dismount all units associated with the DRM configuration.
 - c. Disconnect the host port Fibre cables from the controller being replaced.
 - d. Remove the controller by completing the instructions in the [“Removing array controllers in dual-redundant controller configurations”](#) section which starts on page 121.
 - e. Install the controller by completing the instructions in the [“Installing array controllers in dual-redundant controller configurations”](#) section which starts on page 126.

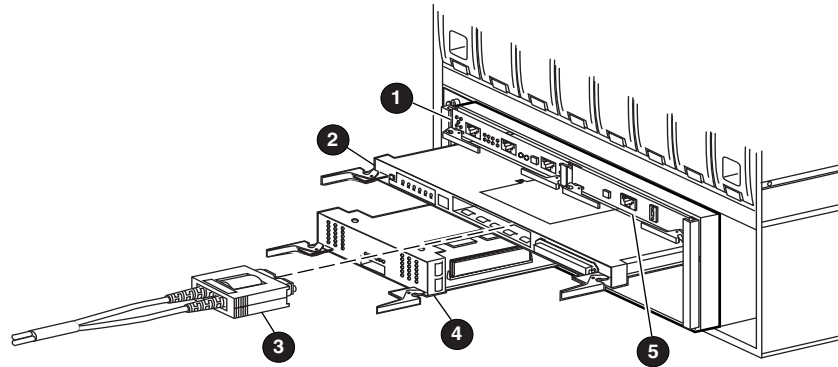
Replacing array controllers

The following subsections cover the topics listed below:

- [Replacing array controllers in a single-controller configurations](#), page 112
- [Replacing array controllers in dual-redundant configurations](#), page 119

Replacing array controllers in a single-controller configurations

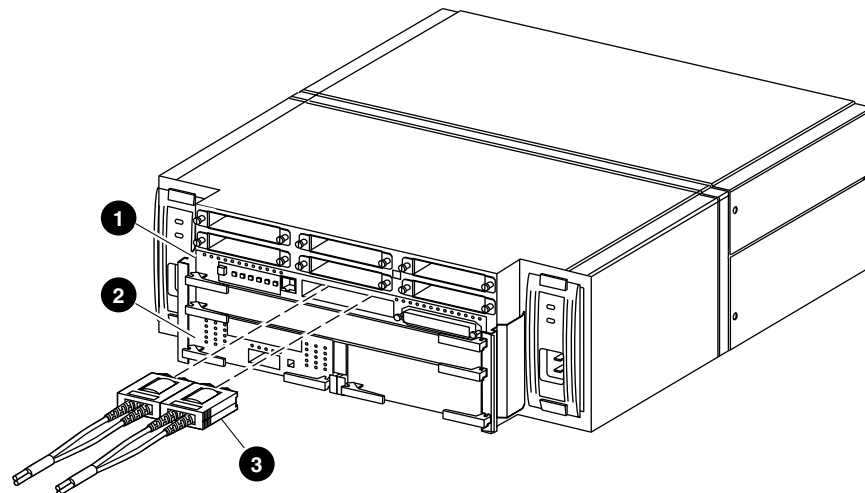
[Figure 42](#) on page 113 and [Figure 43](#) on page 113 provides an illustration of a single-controller setup for a BA370 enclosure and a Model 2200 enclosure.



CXO7072A

- | | |
|--|-------------------------------|
| ❶ EMU | ❷ Cache module in cache A bay |
| ❸ HSG80 array controller in controller A bay | ❹ PVA module |
| ❺ Fiber optic cable with extender clip | |

Figure 42: Single-controller configuration in a BA370 enclosure



CXO7178A

- | | |
|----------------|--|
| ❶ Controller A | ❷ Fiber optic cable with extender clip |
| ❸ Cache A | |

Figure 43: Single-controller configuration in a Model 2200 enclosure

Removing controllers in single-controller configurations

Perform the following steps to remove a controller in a single-controller configuration:

1. Connect a PC or terminal to the controller maintenance port (see [Figure 44](#)) if the controller is operational. If the controller is not operational, proceed to [step 7](#) on page 116.

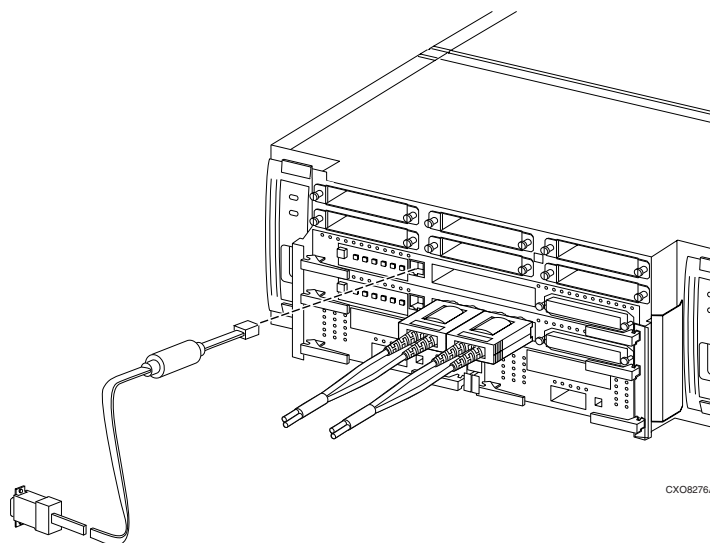


Figure 44: Connecting PC and terminal cables to the controller maintenance port (dual-redundant configuration shown)

2. From the host console, halt all host activity to the controller, and dismount the logical units in the subsystem.
3. If you are using Microsoft Windows NT or Windows 2000, shut down the server.
4. Run the *Fault Management Utility (FMU)* to obtain the last failure codes, if necessary.
5. Determine whether the disk was initialized with the `SAVE_CONFIGURATION` switch, and then perform one of the following options:
 - Locate existing information that supports the manual configuration of the subsystem, and then proceed to [step 6](#) on page 115 if the disk was not initialized with the `SAVE_CONFIGURATION` switch.

- Enter the following CLI command from the controller prompt to save the current device configuration for “this controller” if the disk was initialized with the *SAVE_CONFIGURATION* switch:

```
CONFIGURATION SAVE
```

6. Shut down “this controller” with the following command:

```
SHUTDOWN THIS_CONTROLLER
```

Note: After the controller shuts down, the **Reset** button and the first three LEDs turn on (see [Figure 45](#)). This process can take several minutes, depending on the amount of data that needs to be flushed from the cache module. Proceed only after the **Reset** button stops flashing and remains on.

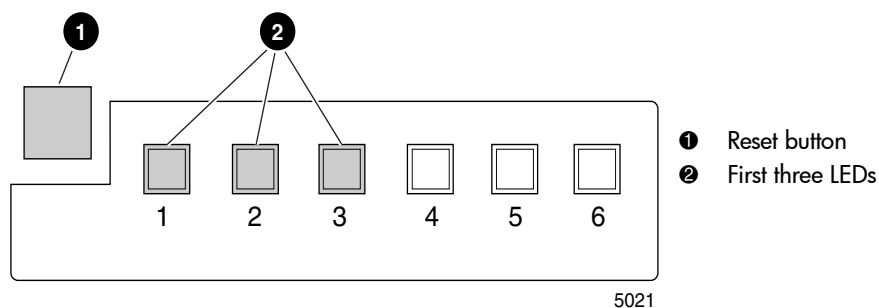
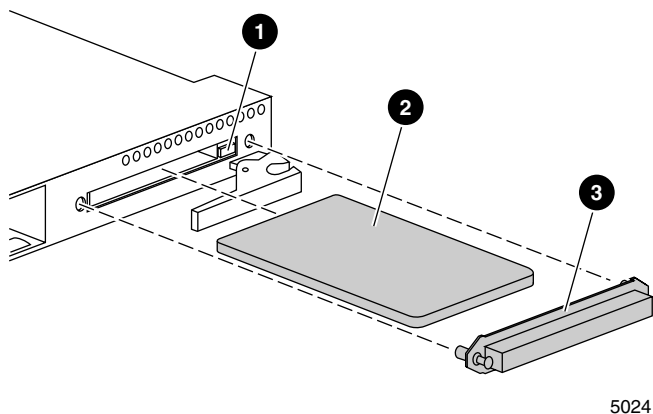


Figure 45: Controller LEDs and Reset button



Caution: The cache module might contain unwritten data if the controller becomes inoperable and it is not shut down with the *SHUTDOWN THIS_CONTROLLER* command. Loss of data could occur.

7. Remove the program card ESD cover (see [Figure 46](#)) and the program card, and save them in an antistatic bag or on a grounded antistatic mat for the replacement controller.



- ❶ Program card slot Eject button
- ❷ Program card

- ❸ ESD cover

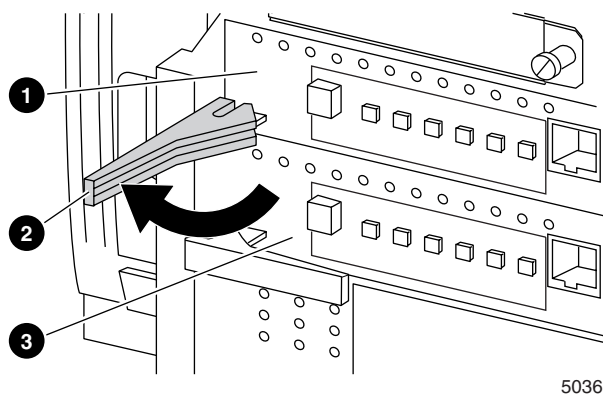
Figure 46: Removing the controller ESD cover

8. Disconnect all host bus cables or terminators from the controller.

Note: Use thin needle nose pliers to disconnect the cables if the extender clips are not installed on the optical cables.

9. If connected, disconnect the PC or terminal from the controller maintenance port.

10. Disengage both retaining levers (see [Figure 47](#)), remove the controller, and then place the controller in an antistatic bag or on a grounded antistatic mat.



- ❶ Controller A
- ❷ Controller retaining levers
- ❸ Controller B

Figure 47: Disengaging the controller retaining levers (dual-redundant configuration shown)

Installing controllers in single-controller configurations

Perform the following steps to install a controller in a single-controller configuration:



Caution: Carefully align the controller in the appropriate guide rails. Misalignment can damage the backplane.

Note: Ensure that the program card is *not* installed in the controller.

1. Insert the replacement controller into controller A bay, and then engage the retaining levers.
2. Connect a PC or terminal to the controller maintenance port.
3. Press and hold the **Reset** button while inserting the program card into the controller.

4. Without releasing the **Reset** button, press and hold the **Port #5** button on the controller.
5. Release the **Reset** button.
The controller resets its internal configuration cache and halts with an OCP code 33. LEDs 6, 5, 2, and 1, and the **Reset** button LED light up. The controller also resets its baud rate to 9600.
6. Release the **Port #5** button.
7. Press and release the **Reset** button.
8. The controller restarts. This process may take up to three minutes.

Note: Perform the following steps if the controller did not restart:

- a. Press and hold the **a.Reset** button.
 - b. Reseat the controller program card.
 - c. Release the **Reset** button.
-

9. Display details about the configured controller by entering the following command:

`SHOW THIS_CONTROLLER FULL`
10. Determine whether the cache is good, and then perform one of the following options:
 - If the cache is *not* good, see [Table 14](#) through [Table 16](#) in the “[Controller and Cache Replacement Troubleshooting](#)” appendix that starts on page 253.
 - If the cache is good, proceed to the next step.
11. Configure the controller as described in the appropriate array controller user guide or *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Command Line Interface Reference Guide*.
12. Determine whether the current device configuration is saved on a disk drive, and then perform one of the following options:
 - If the current device configuration is not saved on a disk drive, manually restore the current device configuration using existing information and the appropriate array controller user guide or *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Command Line Interface Reference Guide*.

- Automatically restore the configuration by entering the following command below if the current device configuration is saved on a disk drive:

CONFIGURATION RESTORE

13. Determine whether configuration restore process completed successfully, and then perform one of the following options:
 - Perform the following substeps if the configuration restore process did not complete successfully:
 - a. Reset the PC or terminal baud rate to match the original configuration of the controller.
 - b. Repeat [step 10](#) and [step 11](#) on page 118.
 - c. Proceed to the next step after a successful configuration.
 - Proceed to the next step if the configuration restore process completed successfully.
14. Connect all host bus cables or terminators to the controller.
15. Mount the logical units on the host.
16. Restart the server if you are using Windows NT or Windows 2000.
17. Disconnect the PC or terminal from the controller maintenance port.
18. Install the program card ESD cover (see [Figure 46](#) on page 116).

Replacing array controllers in dual-redundant configurations

The procedures in the following subsections apply to HSG60 and HSG80 controllers in one of the following enclosures:

- HP StorageWorks BA370 enclosure
- HP StorageWorks M2100 or M2200 enclosures

Figure 48 and Figure 49 provide an illustration of the BA370 and Model 2200 and Model 2200 enclosures in a dual-redundant configurations.

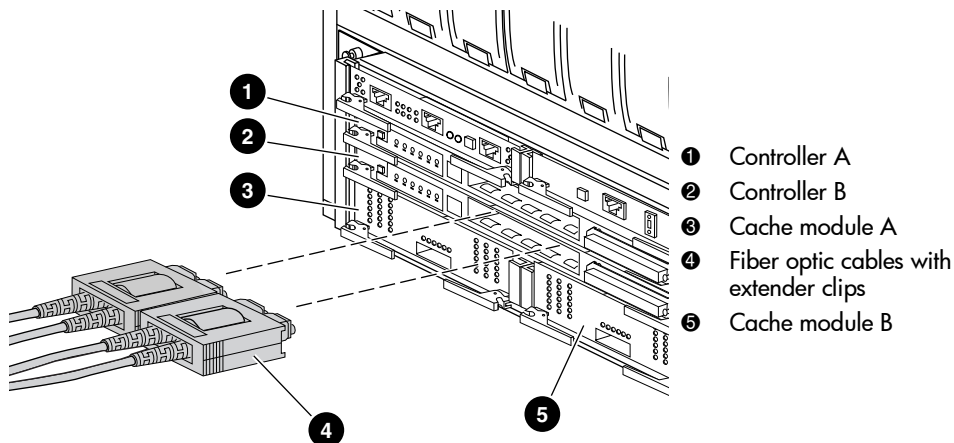


Figure 48: Dual-redundant controller and cache module setup in a BA370 enclosure

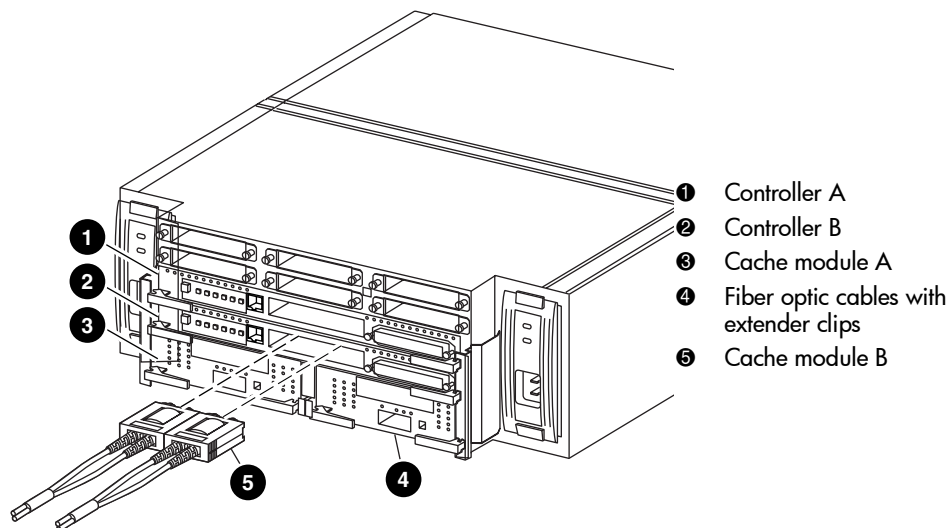


Figure 49: Dual-redundant controller and cache module setup in M2100 and M2200 enclosures

To differentiate on which component activity is being completed, symbols are displayed in the margin of text for your convenience. [Table 9](#) describes those symbols.

Table 9: Replacement Procedure Symbols

Symbol	Description
▲	Indicates that the procedural step must be completed for the <i>operational</i> controller, which is <i>not</i> being replaced.
↻	Indicates that the procedural step must be completed for the <i>controller or cache module that has failed or is to be replaced</i> .
🌀	Indicates that the procedural step must be completed for the <i>field replaceable unit (FRU), new or replacement controller, or new or replacement cache module being installed</i> .



Caution: Electrostatic discharge (ESD) can easily damage the controller. Wear a snug-fitting, grounded ESD wrist strap when completing controller removal and installation procedures.

Removing array controllers in dual-redundant controller configurations

Perform the following steps to remove a controller in a dual-redundant controller configuration:

- ↻ 1. If the controller to be replaced (↻) is functional, complete the following substeps. Otherwise, go to [step 2](#) on page 122:
 - ↻ a. Connect a PC or terminal to the maintenance port of the controller.
 - ↻ b. Press **Enter** or **Return** 2 or 3 times to display the controller prompt.
 - c. Start the *Virtual Terminal Display (VTDPY) Utility* by entering the following command:


```
RUN VTDPY
```
 - ↻ d. Record which units have I/O activity.
 - ↻ e. Exit *VTDPY* by pressing **Ctrl+Y**.

- ↺ f. Restart the controller by entering the following command:

```
RESTART THIS_CONTROLLER
```

Note: Restarting the controller ensures that the unit persistent reservation flags transfer to the operational controller.

- ↺ g. Disconnect the PC or terminal from the maintenance port.

- ▲ 2. For the operational controller (▲), complete the following substeps:

- ▲ a. Connect a PC or terminal to the maintenance port of the operational controller (see [Figure 44](#) on page 114).

Note: The controller connected to the PC or terminal becomes “this controller.” The controller being removed becomes the “other controller.”

- ▲ b. Set the terminal baud rate to match the controller baud rate, and then press **Enter** or **Return** 2 to 3 times to display the controller prompt.

- ▲ c. Display and note configuration information (for example, the Failover mode, cache status, serial numbers, SCSI mode, and so forth) for the operational controller by entering the following command:

```
SHOW THIS_CONTROLLER
```

- ▲ d. Verify that the I/O for the controller that is being replaced fails over to the operational controller (see [substep 1d](#) on page 121) by entering the following command:

```
RUN VTDPY
```

Note: In Transparent Failover mode, units that failed over due to a `RESTART` command revert back to the preferred controller after about 1 minute.

- ▲ e. Exit *VTDPY* by pressing **Ctrl+Y**.
- ▲ f. Disable Failover mode, and take the controllers out of the dual-redundant configuration by entering the following command:

```
SET NOFAILOVER
```
- ↻ 3. For the controller to be replaced (↻), complete the following substeps:
 - ↻ a. Ensure that the **Reset** button (see [Figure 45](#) on page 115) is a constant green.
 - ↻ b. Remove the program card ESD cover (see [Figure 46](#) on page 116).
 - ↻ c. Remove the program card from the controller being replaced by pressing the program card slot **Eject** button (see [Figure 46](#) on page 116).
 - ↻ d. Save the ESD cover and program card in an antistatic bag or on a grounded antistatic mat for use with the replacement controller.
- ▲ 4. For the operational controller, complete the following substeps:
 - ▲ a. Start *FRUTIL* by entering the following command:

```
RUN FRUTIL
```

FRUTIL automatically asks if you intend to replace the controller cache battery.
 - ▲ b. Enter **N(o)**.

The **FRUTIL Main Menu** is displayed (see [Figure 50](#) and [Figure 51](#) on page 124).

```
FRUTIL Main Menu:
1. Replace or remove a controller or cache module
2. Install a controller or cache module
3. Replace a PVA module
4. Replace an I/O module
5. Exit

Enter choice: 1,2,3,4,5 ->
```

Figure 50: FRUTIL Main Menu for a controller in a BA370

```

FRUTIL Main Menu
1. Replace or remove a controller or cache module
2. Install a controller or cache module
3. Replace an I/O module
4. Exit

Enter choice: 1,2,3,4 ->

```

Figure 51: FRUTIL Main Menu for a controller in M2100 and M2200 enclosures

- ▲ c. Enter option **1** to remove the controller.

The **Replace or remove Options** screen is displayed (see [Figure 52](#)).

```

Replace or remove Options:
1. Other controller and cache module
2. Other controller module
3. Other cache module
4. Exit

Enter choice: 1,2,3,4 ->

```

Figure 52: Replace or remove Options screen

- ▲ d. Enter option **2** to remove the controller being replaced.

The **Slot Designations** screen is displayed (see [Figure 53](#) and [Figure 54](#) on page 125).

```

Slot Designations (BA370)
      (front view)
[ ---- EMU ---- ][ ---- PVA ---- ]
[ ----- Controller A ----- ]
[ ----- Controller B ----- ]
[ Cache Module A ][ Cache Module B ]

```

Figure 53: Slot Designations screen for controllers in a BA370 enclosure

Slot Designations M2100/M2200		
(back view)		
[Port1]	[Port3]	[Port5]
[Port2]	[Port4]	[Port6]
[----- Controller A -----]		
[----- Controller B -----]		
[Cache Module A]	[Cache Module B]	

Figure 54: Slot Designations screen for controllers in M2100 and M2200 enclosures

- ↺ e. Ensure that the program card was removed from the controller to be replaced. Do not proceed until it is removed.
- ▲ f. Enter **Y(es)** to confirm the intent to remove the “other controller.”



Caution: Wait for *FRUTIL* to quiesce the device ports—indicated by an **All device ports quiesced** message. Failure to allow the ports to quiesce can result in data loss. Quiescing can take several minutes.

Note: After the ports quiesce, a countdown timer allows you a total of 2 minutes to remove the controller. After 2 minutes, the operational controller exits *FRUTIL* and resumes operations. If this happens, return to [step 4](#) on page 123 and proceed.

- ↺ 5. For the controller to be replaced, complete the following substeps:



Caution: For fiber optic cables without extender clips, use thin needle-nose pliers to remove the cable from the controller to prevent damaging the cable.

- ↺ a. Disconnect all host bus cables from the controller being removed.
- ↺ b. Disengage both controller retaining levers, and then remove the controller from the enclosure (see [Figure 47](#) on page 117).
- ↺ c. Place the controller in an antistatic bag or on a grounded antistatic mat.

- ▲ 6. For the operational controller, complete the following substeps:
 - ▲ a. Observe that after the “other controller” is removed that *FRUTIL* restarts all device ports and asks if a replacement controller is available.
 - ▲ b. Enter **N(o)** after *FRUTIL* asks you if a replacement controller is available, and then disconnect the PC or terminal from the controller maintenance port. *FRUTIL* exits. If you have a replacement controller available, complete the instructions in the “[Installing array controllers in dual-redundant controller configurations](#)” section.



Caution: If reverting to a single-controller configuration, fill the vacant controller bay with a blank bezel to prevent the enclosure from developing an over-temperature condition.

Installing array controllers in dual-redundant controller configurations



Caution: Ensure that the controller being installed has the same ACS version as the operational and previous controller. Failure to follow this precaution causes controller configuration information to be erased, and the controller to be rendered unusable.

- ▲ 1. For the operational controller, complete the following substeps:
 - ▲ a. Connect a PC or terminal to the maintenance port of the operational controller if not already connected.

Note: The controller connected to the PC or terminal becomes “this controller.” The controller being removed becomes the “other controller.”

- ▲ b. Ensure that the controller configuration is customized to your needs, and then record the controller configurations (for example, Failover mode, cache status, serial numbers, SCSI mode, mirrored or nonmirrored information, and so forth).

- ▲ c. Start *FRUTIL* by entering the following command:

```
RUN FRUTIL
```
- ▲ d. Enter **N(o)** to the question about replacing the cache battery.
The **FRUTIL Main Menu** is displayed.
- ▲ e. Enter option **2** to install a controller or cache module.
If both the controller and cache are missing, the **Install Options** screen is displayed (see [Figure 55](#)).

```
Install Options:
1. Other controller and cache module
2. Other controller module
3. Other cache module
4. Exit

NOTE: OPTION 1 DISABLED (So: Do cache, then controller.)
Enter choice: 1,2,3,4 ->
```

Figure 55: Install Options screen

- ▲ f. Enter option **4** to exit *FRUTIL*, and then proceed to the “[Installing cache modules in dual-redundant controller configurations](#)” section that starts on page 142 if both the controller and cache modules have been removed. Otherwise, continue to the next substep.
- ▲ g. Enter **Y(es)** to confirm the intent to install the “other controller.”
FRUTIL quiesces the device ports and displays a message indicating that the controller is being installed.



Caution: Wait for *FRUTIL* to quiesce the device ports—indicated by an All device ports quiesced message. Failure to allow the ports to quiesce can result in data loss. Quiescing can take several minutes. The length of time is dependent on the amount of I/O activity and the number of units that are online.

Note: If *FRUTIL* times out before a replacement controller is installed, restart *FRUTIL*.

2. For the replacement controller, complete the following substeps:
 - a. Remove the program card in the replacement controller if it is installed.
 - b. Insert the replacement controller (*without the program card installed*) into the appropriate bay, and engage the controller retaining levers.
 - c. Press and hold the **Reset** button, insert the program card, and continue holding the **Reset** button.
 - d. Press and hold the replacement controller **Port #5** button, release the **Reset** button, and continue holding the **Port #5** button for an additional 5 to 20 seconds (see [Figure 45](#) on page 115).

The nonvolatile memory in the replacement controller is updated, and the controller halts with an LED code of 33. Port LEDs 1, 2, 5, and 6 are on (see [Figure 45](#) on page 115).
 - e. Press and release the **Reset** button.

The replacement controller restarts normally.
 - f. Wait at least 15 seconds after releasing the **Reset** button, and then immediately complete [substep 3a](#) below. Be sure to wait 15 seconds *before* continuing to [substep 3a](#).

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

- ▲ 3. For the operational controller, complete the following substeps:
 - ▲ a. Press **Enter** or **Return** within 3 minutes of completing [substep 2f](#) above to exit *FRUTIL*, and then wait 1 minute to allow the replacement controller to restart.

Note: If **Enter** or **Return** is not pressed within 3 minutes in [substep 3a](#) above, the operational controller issues an automated command to cancel the installation of the replacement controller. This cancellation causes all the port LEDs on the replacement controller to go off. If this situation occurs, press **Enter** to exit *FRUTIL*, and then enter the following command from the operational controller:

```
RESTART OTHER_CONTROLLER
```

- ▲ b. Verify that the status of the cache of the operational controller is good by entering the following command:

```
SHOW THIS_CONTROLLER
```
- ▲ c. Complete one of the following steps from the operational controller:
 - ▲ ■ If the controller reported that the cache and mirrored cache (if enabled) is good in [substep 3b](#), proceed to [substep 3d](#) below.
 - ▲ ■ If the controller reported that the cache and mirrored cache (if enabled) is not good in [substep 3b](#), see [Table 14](#) through [Table 16](#) in the “[Controller and Cache Replacement Troubleshooting](#)” appendix (which starts on page 253) to take corrective actions.
- ▲ d. Disconnect the PC or terminal from the maintenance port of the operational controller.

4. For the replacement controller, complete the following substeps:
 - a. Connect a PC or terminal to the maintenance port of the replacement controller.
 - b. Perform the following:
 - i. Set the terminal baud rate to 9600.
 - ii. Press **Enter** or **Return** several times to get a prompt.
 - iii. Proceed to the next substep.
 - c. Verify that the controller restarts in the following reset configuration by entering the following command:


```
SHOW THIS_CONTROLLER
```

 - Verify that the controller prompt displays HSG>.
 - Verify that the NODE_ID is 0000-0000-0000-0000.
 - Verify that mirrored cache matches the original configuration.
 - Verify that the controller cache is good. See [Table 14](#) through [Table 17](#) in the “[Controller and Cache Replacement Troubleshooting](#)” appendix that starts on page 253 if the cache is not good.



Caution: Failure to clear an invalid cache message (especially a Cache is FAILED message) in [substep 4c](#) *before* setting the Failover mode can result in a recursive bugcheck condition that renders the controller unusable.

- d. Disconnect the PC or terminal from the maintenance port of the replacement controller.

- ▲ 5. For the operational controller, complete the following substeps:
 - ▲ a. Connect a PC or terminal to the maintenance port of the operational controller.



Caution: In [substep 5b](#) below, entering the appropriate `SET` command is critical. Enabling an incorrect Failover mode can cause loss of data and incur system downtime.

- ▲ b. Restore the Failover mode and re-establish the dual-redundant controller configuration with one of the following commands. For example, if you noted that the Failover mode in [substep 1c](#) on page 122 was Multibus, enter the second command below.

```
SET FAILOVER  
COPY=THIS_CONTROLLER
```

or

```
SET MULTIBUS_FAILOVER  
COPY=THIS_CONTROLLER
```

The above commands copy the subsystem configuration from the operational controller to the controller that failed or is being replaced.

- ▲ c. Verify that the replacement controller restarts and that the cache for both the operational and replacement controller is good by entering the following commands:

```
SHOW THIS_CONTROLLER  
SHOW OTHER_CONTROLLER
```

Note: See [Table 14](#) through [Table 16](#) in the “[Controller and Cache Replacement Troubleshooting](#)” appendix that starts on page 253 if the cache is not good.

Note: The replacement controller can fail with a recursive bugcheck (OCP code 25), and the **Reset** button LED remains steady on. Contact HP technical support or replace the controller if this condition occurs.

- ▲ 6. Disconnect the PC or terminal from the controller maintenance port of the operational controller.
- 🔧 7. Connect the host bus cables to the replacement controller.
- 🔧 8. Install the program card ESD cover on the controller being replaced.

Replacing cache modules

Replacing a cache module involves transferring the cache memory DIMMs from the failed cache module to the replacement cache module. Use the procedures in this section to replace a cache module in either single or dual-redundant controller configurations.

Note: With ACS V8.8-*x*, *FRUTIL* prohibits you from installing both the controller and cache module in one process.

This section contains the following topics:

- [Replacing cache modules in single-controller configurations](#), page 134
- [Replacing cache modules in dual-redundant controller configurations](#), page 138

Note: In dual-redundant configurations, both cache modules *must* contain the same memory configuration, regardless of the ACS version.

Figure 56 and Figure 57 provide general information about the cache module.

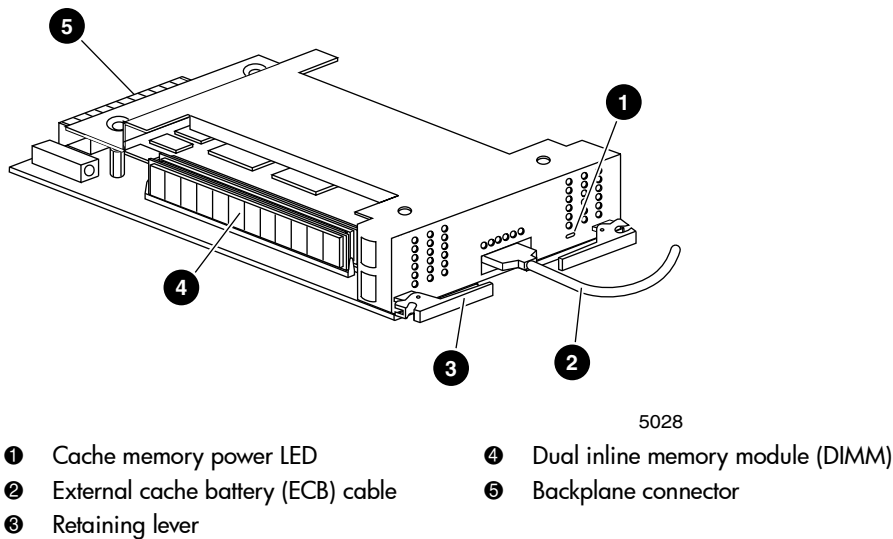


Figure 56: Cache module

Note: In Figure 57, the environmental monitoring unit (EMU) and power verification assembly (PVA) modules are present in only HP StorageWorks BA370 enclosures. The controller and cache module locations are consistent with other HP StorageWorks controller enclosures.

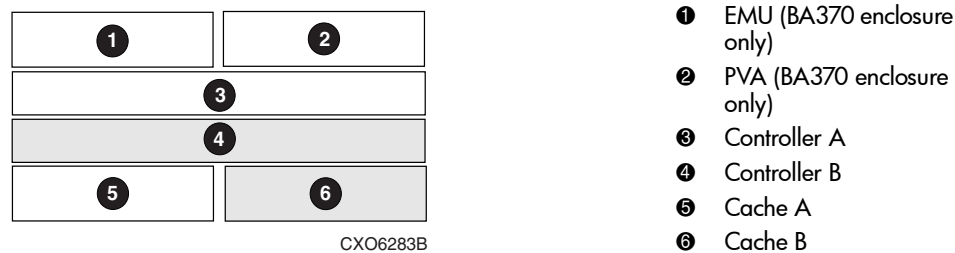


Figure 57: Cache module locations

Replacing cache modules in single-controller configurations

Complete the steps in the following subsections to replace HSG60 and HSG80 cache modules in single-controller configurations.



Caution: ESD can easily damage the cache module or a DIMM. Wear a snug-fitting, grounded ESD wrist strap when completing controller cache module removal and installation procedures.

Removing cache modules from single-controller configurations

Perform the following steps to remove a cache module in a single-controller configuration:

1. Determine whether the controller is operational, and then complete one of the following two options:
 - If the controller is operational, connect a PC or terminal to the controller maintenance port, and then proceed to [step 2](#).
 - If the controller is *not* operational, proceed to [step 7](#) on page 135.
2. From the host console, stop all host activity to the controller, and then dismount the logical units in the subsystem.
3. If you are using Microsoft Windows 2000 or Windows NT, shut down the server.
4. Run the *FMU* to obtain the last failure codes, if necessary.
5. Shut down “this controller” by entering the following command:

```
SHUTDOWN THIS_CONTROLLER
```
6. Proceed to the next step only after the **Reset** button stops flashing and remains on.

Note: After the controller shuts down, the **Reset** button and the first three port LEDs light up. This can take several minutes, depending on the amount of data that needs to be flushed from the cache module.

7. For the cache module to be replaced, complete one of the following two options:
- For cache modules in an M2100 or M2200 enclosure, disengage both cache module retaining levers, and remove the cache module.
 - For cache modules in a BA370 enclosure, complete the following substeps:
 - a. Disengage both cache module retaining levers, and partially remove the cache module—about halfway.



Caution: You must disable the ECB before disconnecting the ECB Y-cable. (If the ECB status light is off, this indicates that the ECB is disabled.) Failure to do so can result in cache module damage.

- b. Disable the ECB by pressing the battery disable switch until the status light stops flashing. The status light should stop flashing in approximately 5 seconds.

Note: Refer to the documentation that shipped with the ECB for additional battery information.

- c. Disconnect the ECB Y-cable from the cache module.
 - d. Remove the cache module from the enclosure.
 - e. Place the cache module on a grounded antistatic mat or in an antistatic bag.

Note: The DIMMs must be removed for installation in the replacement cache module.

8. Note the location for each DIMM in the cache module that is being replaced, and install the DIMMs in the corresponding locations in the replacement cache module. Use the following substeps to remove the DIMMs:

Note: To facilitate pressing down on the DIMM retaining clips, consider using the eraser end of a pencil or a small screwdriver.

- a. Press down on the DIMM retaining clips (see [Figure 58](#)) at both ends of the DIMM being removed.

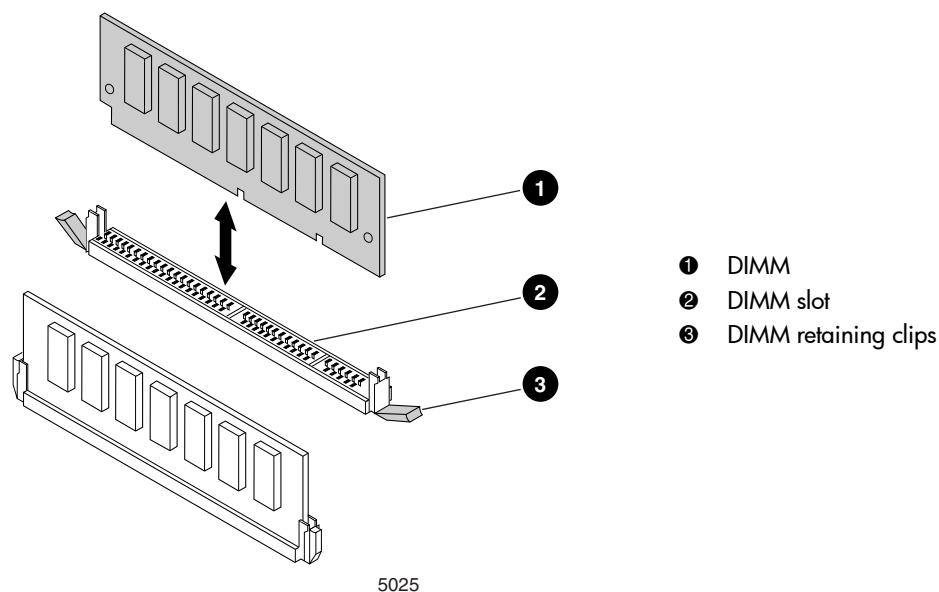


Figure 58: Removing or installing a DIMM

- b. Gently remove the DIMM from the DIMM slot, and then place the DIMM on an antistatic bag or a grounded antistatic mat.
- c. Repeat [substep 8a](#) and [substep 8b](#) for each DIMM.
- d. Proceed to the “[Installing cache modules in single-controller configurations](#)” section that starts on page 137 to install the DIMMs in the replacement cache module.

Installing cache modules in single-controller configurations

Perform the following steps to install HSG60 and HSG80 cache modules in single-controller configurations.

Note: The replacement cache modules *must* contain the same memory configuration as that of the cache module which was removed.

1. Insert each DIMM (from the cache module that was removed) straight into the appropriate slot of the replacement cache module (see [Figure 58](#) on page 136). Ensure that the notches in the DIMM align with the tabs in the slot. Use the following substeps to install the DIMMs:
 - a. Press the DIMM gently into the slot until it is seated at both ends.
 - b. Ensure that the two retaining clips for the DIMM are engaged.
 - c. Ensure that both ends of the DIMM are firmly seated in the slot and both retaining clips engage the DIMM.
 - d. Repeat [substep 1a](#) through [substep 1c](#) above for each DIMM.



Caution: Misaligning the module can damage the backplane.

2. Carefully align and partially insert the cache module in the Cache A guide rails.



Caution: If your cache module is in a BA370 enclosure, you must disable the ECB. Failure to disable the ECB can result in cache module damage. To disable the ECB, complete the following steps:

1. Disable the ECB by pressing the battery disable switch on the battery module.
 2. Connect the ECB Y-cable to the cache module.
-
3. Insert the replacement cache module completely into the appropriate bay, and then engage the cache module retaining levers.
 4. Connect a PC or terminal to the controller maintenance port for the replacement cache module, if not already connected.

5. Restart the controller by pressing the **Reset** button.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

Note: If the controller did not restart, use the following steps:

- a. Press and hold the **Reset** button.
 - b. Reseat the controller program card.
 - c. Release the **Reset** button.
-

6. From the CLI prompt, display details about the configured controller by entering the following command:

```
SHOW THIS_CONTROLLER FULL
```

7. Set the date and time by entering the following command:

```
SET THIS_CONTROLLER TIME=dd-mm-yyyy:hh:mm:ss
```

8. Mount the logical units on the host.
9. If using a Windows 2000 or Windows NT platform, restart the server.
10. Disconnect the PC or terminal from the controller maintenance port.

Replacing cache modules in dual-redundant controller configurations

This subsection describes how to remove or replace HSG60 and HSG80 cache modules in dual-redundant controller configurations.



Caution: ESD can easily damage the cache module or a DIMM. Wear a snug-fitting, grounded ESD wrist strap when completing controller cache module removal and installation procedures.

Note: See [Table 9](#) on page 121 for information on symbols used throughout these instructions.

Removing cache modules in dual-redundant controller configurations

Perform the following steps to remove HSG60 and HSG80 cache modules in dual-redundant controller configurations:

- ↺ 1. For the controller associated with the cache module to be replaced, complete the following substeps:
 - ↺ a. Connect a PC or terminal to the maintenance port.
 - ↺ b. Run *VTDPY* by entering the following command:

```
RUN VTDPY
```
 - ↺ c. Record which units have I/O activity.
 - ↺ d. Exit *VTDPY* by pressing **Ctrl+Y**.

Note: In Transparent Failover mode, units that failed over due to a `RESTART` command revert back to preferred controller after about 1 minute. The next step may not show that the units have failed over.

- ↺ e. Restart the controller by entering the following command:

```
RESTART THIS_CONTROLLER
```
- ↺ f. Disconnect the PC or terminal from the maintenance port of the controller having its cache module replaced.
- ▲ 2. For the operational controller, complete the following substeps:
 - ▲ a. Connect the PC or terminal to the maintenance port of the operational controller.

Note: The controller connected to the PC or terminal becomes “this controller.” The controller for the cache module being removed becomes the “other controller.”

- ▲ b. Display and note the configuration information (for example, the Failover mode, cache status, serial numbers, SCSI mode, and so forth) for the operational controller by entering the following command:

```
SHOW THIS_CONTROLLER
```
- ▲ c. Disable failover and take the controllers out of the dual-redundant configuration by entering the following command:

```
SET NOFAILOVER
```
- ▲ d. Start the *FRUTIL* by entering the following command:

```
RUN FRUTIL
```

FRUTIL automatically asks you if you want to replace the controller cache battery.
- ▲ e. Enter **N(o)**.
- ▲ f. Enter **1** for the **Replace or remove a controller or cache module** option.



Caution: Early removal of the cache module may cause the controller to become inoperable. To prevent this, wait for *FRUTIL* to instruct you to remove the cache module. *FRUTIL* displays the following message when it is ready for you to remove the cache module:

Remove the slot *x* cache module within 2 minutes.

- ▲ g. Enter **3** for the **Other cache module** option.
- ▲ h. Enter **Y(es)** to confirm the intent to remove the slot *x* cache module. *FRUTIL* quiesces all device ports.



Caution: Wait for *FRUTIL* to quiesce the device ports—indicated by an `All device ports quiesced` message. Failure to allow the ports to quiesce can result in data loss. Quiescing can take several minutes.

Note: A countdown timer allows you a total of 2 minutes to remove the cache module. After 2 minutes, "this controller" exits *FRUTIL*, restarts the "other controller," and resumes operations. If this happens, perform the following steps:

- a. Connect the PC or terminal to the "other controller."
 - b. Shut down the "other controller" by issuing the command:
`SHUTDOWN THIS_CONTROLLER`
 - c. Disconnect the PC or terminal, and reconnect it to the operational controller.
 - d. Return to [substep 2d](#) on page 140, and proceed.
-

↺ 3. For the cache module to be replaced, complete one of the following two options after the Remove the slot x cache module within 2 minutes message is displayed:

↺ ■ For Model 2100 and 2200 enclosures:

- ↺ a. Disengage both retaining levers.
- ↺ b. Remove the "other controller" cache module.

↺ ■ For all other supported enclosures:

- ↺ a. Disengage both retaining levers and partially remove the "other controller" cache module—about halfway.
-



Caution: You must disable the ECB before disconnecting the ECB Y-cable from the cache module. (If the ECB status light is off, this indicates that the ECB is disabled.) Failure to disable the ECB can result in cache module damage.

- ↺ b. Disable the ECB by pressing the battery disable switch until the status light stops flashing. This process takes approximately 5 seconds.
- ↺ c. Disconnect the ECB Y-cable from the "other controller" cache module.
- ↺ d. Remove the cache module from the enclosure.

- ▲ 4. For the operational controller, observe that *FRUTIL* restarts I/O ports, disables writeback caching and mirrored writes, indicates that the mirrored cache is disabled, and terminates.
- ↺ 5. Enter **N(o)** to the question for a replacement cache module.
FRUTIL exits.
- ▲ 6. For the operational controller, place the cache module on an antistatic bag or a grounded antistatic mat.
- ↺ 7. For the cache module to be replaced, note the location for each DIMM in the cache module that was replaced, and then install the DIMMs in the corresponding locations in the replacement cache module. Use the following substeps to remove the DIMMs:

Note: The DIMMs must be removed from the cache module that was removed for installation in the replacement cache module.

- ↺ a. Press down on the DIMM retaining clips at both ends of the DIMM being removed.
- ↺ b. Gently remove the DIMM from the DIMM slot, and place the DIMM on an antistatic bag or a grounded antistatic mat.
- ↺ c. Repeat [substep 7a](#) and [substep 7b](#) above for each DIMM.

Installing cache modules in dual-redundant controller configurations








Perform the following steps to install HSG60 and HSG80 cache modules in dual-redundant controller configurations:




Caution: ESD can easily damage a cache module or a DIMM. Wear a snug-fitting, grounded ESD wrist strap while replacing a cache module.



Note: The replacement cache module *must* contain the same cache memory configuration as the module being replaced.

Note: If you are installing a cache module after resolving a failed cache issue (see [Table 14](#) through [Table 16](#) of the “[Controller and Cache Replacement Troubleshooting](#)” appendix that starts on page 253), the operational controller and the replacement controller references that appear in this section may have been reversed. The operational controller is the one attached to the terminal or PC and the one from which *FRUTIL* is executed.

-  1. For the replacement cache module, insert each DIMM straight into the appropriate slot of the replacement cache module ([Figure 58](#) on page 136), ensuring that the notches in the DIMM align with the tabs in the slot. Use the following substeps to install the DIMMs:
 -  a. Press the DIMM gently into the slot until it is seated at both ends.
 -  b. Engage the two retaining clips for the DIMM.
 -  c. Ensure that both ends of the DIMM are firmly seated in the slot and both retaining clips engage the DIMM.
 -  d. Repeat [substep 1a](#) through [substep 1c](#) above for each DIMM.
-  2. For the operational controller, complete the following substeps:
 -  a. Connect a PC or terminal to the operational controller, if not already connected.

Note: The controller connected to the PC or terminal becomes “this controller.” The controller for the replacement cache module becomes the “other controller.”

-  b. Start *FRUTIL* by entering the following command:


```
RUN FRUTIL
```
-  c. Enter **N(o)** to the question about replacing the cache battery.
-  d. From the **FRUTIL Main Menu**, enter **2** for the **Install a controller or cache module** option.

```

Install Options:
1. Other controller and cache module
2. Other controller module
3. Other cache module
4. Exit

NOTE: OPTION 1 DISABLED (So: Do cache, then controller.)
Enter choice: 1,2,3,4 ->
    
```

Figure 59: Install Options screen

- ▲ e. Enter **3** to install the other cache module.
The **Slot Designations** screen is displayed.
- ▲ f. Enter **Y(es)** to confirm the intent to install the slot *x* cache module.
FRUTIL quiesces all device ports, indicates a time limit of 2 minutes to install the replacement cache module, and then begins displaying the time remaining in 10-second intervals.



Caution: Wait for *FRUTIL* to quiesce the device ports—indicated by an **All device ports quiesced** message. Failure to allow the ports to quiesce can result in data loss. Quiescing can take several minutes.

Note: A countdown timer allows you a total of 2 minutes to install the cache module. After 2 minutes, “this controller” exits *FRUTIL* and resumes operations. If this happens, return to [substep 2b](#) and proceed.

- 🌀 3. For the replacement cache module, complete the following substeps:
- 🌀 a. Carefully align and partially insert the cache module in the appropriate guide rails.



Caution: Misalignment of the cache module in the guide rails can damage the backplane.



Caution: If your cache module is in a BA370 enclosure, you must disable the ECB before proceeding to the next step. Failure to disable the ECB can result in cache module damage. To disable the ECB, complete the following steps:

- a. Disable the ECB by pressing the battery disable switch on the battery module.
- b. Connect the ECB Y-cable to the cache module.



- b. After the message, *Install the new cache module in slot x within 2 minutes*, is displayed, insert the replacement cache module completely into the appropriate bay, and then engage the cache module retaining levers.



4. For the operational controller, note that in Mirrored mode, *FRUTIL* initializes the mirrored portion of the replacement cache module, checks for old data on the cache module, and then restarts all device ports. After device ports restart, *FRUTIL* tests the cache module and the ECB. After the test concludes, the device ports are quiesced, and a mirror copy of the cache module data is created on the newly installed cache module.



5. Determine whether the controller associated with the replacement cache module is installed, and complete one of the following options:



- If the controller associated with the replacement cache module is not installed, *FRUTIL* exits automatically. After *FRUTIL* exits, proceed to the “[Installing array controllers in dual-redundant controller configurations](#)” section that starts on page 126.
- If the controller associated with the replace cache module is installed, continue to the next step.







6. For the controller associated with the replacement cache module, note and observe the following:



- The controller restarts.






- The controller restart takes up to 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing controller **Reset** button.

- 
 - If the controller does not restart, complete the following substeps:
 - 
 - a. Press and hold the controller **Reset** button on the controller.
 - 
 - b. Reseat the program card in the controller.
 - 
 - c. Release the controller **Reset** button.
 - ▲ 7. For the operational controller, complete the following substeps:
 - ▲ a. Observe that *FRUTIL* restarts the device ports and then exits.
 - ▲ b. Identify invalid or failed cache conditions by entering the following command:


```
SHOW THIS_CONTROLLER
```
 - ▲ c. Clear invalid or failed cache conditions, if any exist. See [Table 14](#) through [Table 16](#) in the “[Controller and Cache Replacement Troubleshooting](#)” appendix that starts on page 253 for more information on clearing invalid or failed cache conditions.



Caution: Failure to clear an invalid cache message (especially a *Cache is FAILED* message) *before* setting the Failover mode can result in a recursive bugcheck error message that renders the controller unusable.

- ▲ d. Disconnect the PC or terminal from the maintenance port of the operational controller.
- 
 - 8. For the controller associated with the replacement cache module, complete the following substeps:
 - 
 - a. Connect a PC or terminal to the maintenance port of the controller associated with the cache module to be replaced.
 - 
 - b. Identify any invalid or failed cache conditions, if any exist, by entering the following command:


```
SHOW THIS_CONTROLLER
```



- c. Clear invalid or failed cache conditions, if any exist. See [Table 14](#) through [Table 16](#) in the “[Controller and Cache Replacement Troubleshooting](#)” appendix that starts on page 253 for more information on clearing invalid or failed cache conditions.



Caution: Failure to clear an invalid cache message (especially a *Cache is FAILED* message) *before* setting the Failover mode can result in a recursive bugcheck error message that renders the controller unusable.



- d. Disconnect the PC or terminal from the maintenance port of the controller associated with the replacement cache module.



9. For the operational controller, complete the following substeps:



- a. Connect a PC or terminal to the maintenance port.



Caution: In [substep 9b](#) below, entering the appropriate `SET` command is critical. Enabling an incorrect Failover mode can cause loss of data and incur system downtime.

Verify the original failover configuration, and use the appropriate `SET` command to restore this configuration.



- b. Re-establish the previous Failover mode by entering one of the following commands:

```
SET FAILOVER COPY=THIS_CONTROLLER
```

or

```
SET MULTIBUS_FAILOVER  
COPY=THIS_CONTROLLER
```

Note: After you enter the appropriate `SET` command, the controller restarts. A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

The `SET` command copies the subsystem configuration from “this controller” to the “other controller.”

- ▲ c. Verify the failover configuration by entering the following commands:

```
SHOW THIS_CONTROLLER  
SHOW OTHER_CONTROLLER
```
- ▲ d. Verify that the controller cache and, if enabled, mirrored cache are good. If either the cache or mirrored cache is not good, see [Table 14](#) through [Table 16](#) in the “[Controller and Cache Replacement Troubleshooting](#)” appendix that starts on page 253 for more information on clearing invalid or failed cache conditions.
- ▲ e. Disconnect the PC or terminal from the controller maintenance port.

Replacing an ECB

The ECB can be replaced with subsystem power on or off.

Note: HP recommends that you replace the ECB once every 3 ½ years.

A dual ECB (for and HP StorageWorks RA8000) is shown in [Figure 60](#) and contains two batteries. A single ECB contains only one battery.

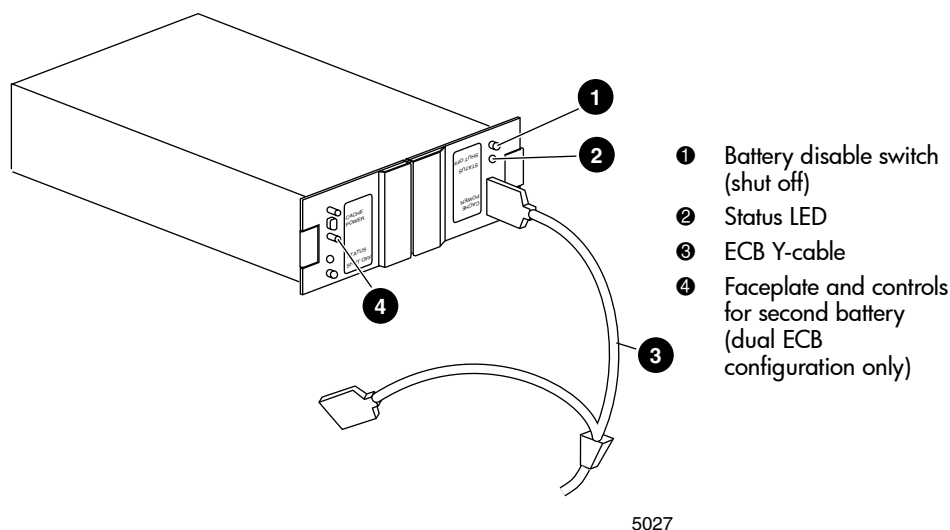


Figure 60: Dual ECB configuration (RA8000 and BA370 example shown)

Model 2100 and 2200 enclosures contain four ECB bays. Two bays support cache module A (A1 and A2) and two bays support cache module B (B1 and B2)—see the relationship in [Figure 61](#) on page 150. When replacing an ECB (see [Figure 63](#) on page 150), match the vacant ECB bay with the cache module the ECB supports.

Note: If you plan to shut down your subsystem for more than one day to replace the ECB, HP recommends that you shut down your subsystem. See the [“Shutting down the subsystem”](#) section that starts on page 102 for details.

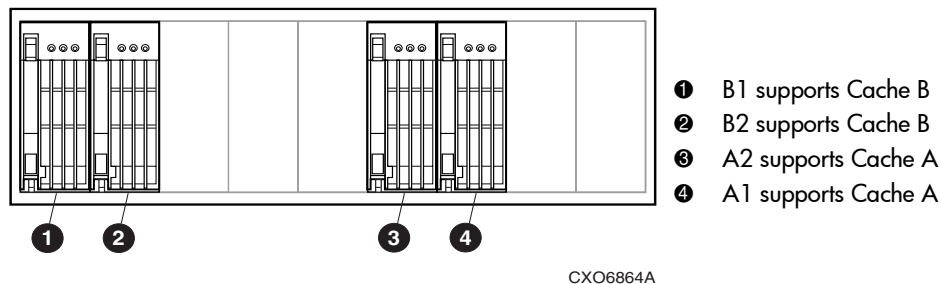


Figure 61: ECB and cache module locations in Model 2100 and 2200 enclosures (front view)

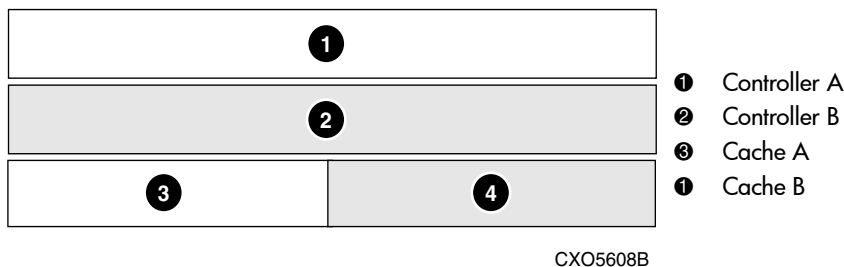


Figure 62: ECB and cache module locations in Model 2100 and 2200 enclosures (rear view)

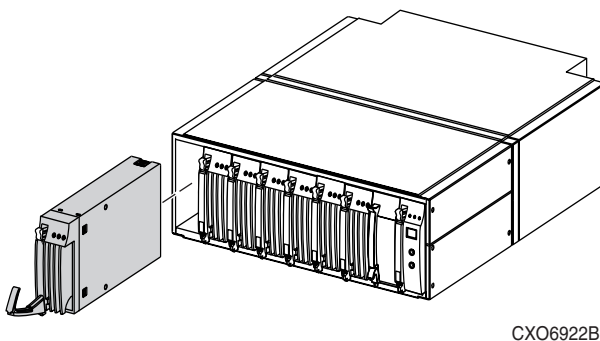


Figure 63: Removing an ECB that supports cache module B in Model 2100 and 2200 enclosures



WARNING: The ECB is a sealed, rechargeable, lead acid battery that must be recycled or disposed of properly according to local regulations or policies after replacement. *Do not* incinerate the battery. The ECB displays the following label:



Replacing an ECB with the subsystem powered on

Use the following steps to replace the ECB with the BA370 subsystem powered on:

Note: For array controllers in M2100 or M2200 enclosures, the *FRUTIL* procedure for a dual-redundant controller configuration assumes that a single ECB with a dual battery is installed and an empty bay is available for the replacement ECB. If an empty bay is not available, place the replacement ECB on top of the enclosure. After removing the old ECB, carefully insert the replacement ECB into the empty bay. For array controllers in a BA370 enclosure, there are two slots for each ECB.

1. Connect a PC or terminal to the maintenance port of the array controller that requires an ECB replacement.

The array controller connected to the PC or terminal becomes “this controller.”

2. For array controllers in a M2200 enclosure, enter the following command to verify that system time is set:

```
SHOW THIS_CONTROLLER FULL
```

If the system time is not set or current, enter the current time using the following command:

```
SET THIS_CONTROLLER TIME=<dd-mm-yyyy:hh:mm:ss>
```

3. Start *FRUTIL* with the following command:

```
RUN FRUTIL
```

4. Enter **Y**(es) to confirm the intent to replace the “this controller” ECB with power on.



Caution: Ensure that at least one ECB is connected to the ECB Y-cable at all times during this procedure. Otherwise, cache memory data is not protected and is subject to loss.

The ECB Y-cable has a 12-volt and a 5-volt pin. Improper handling or misalignment while connecting or disconnecting can cause these pins to contact ground, resulting in cache module damage.

Note: If you are using a BA370 subsystem and upgrading to a dual-redundant controller configuration, if an empty power supply or disk drive bay, or ECB enclosure bay is not available, place the replacement ECB on top of the enclosure.

5. If you are replacing an ECB for an array controller in a M2200 enclosure, complete the following substeps:
 - a. Install a Battery Service Label on the replacement ECB as described in the documentation that shipped with the battery.

Note: The Battery Service Label indicates the installation date (MM/YY) for the replacement ECB.

- b. Remove the blank bezel from the appropriate bay and insert the replacement ECB.

Note: Do *not* remove the old ECB until the ECB charged LED on the replacement ECB turns on (see [Figure 64](#) on page 153).

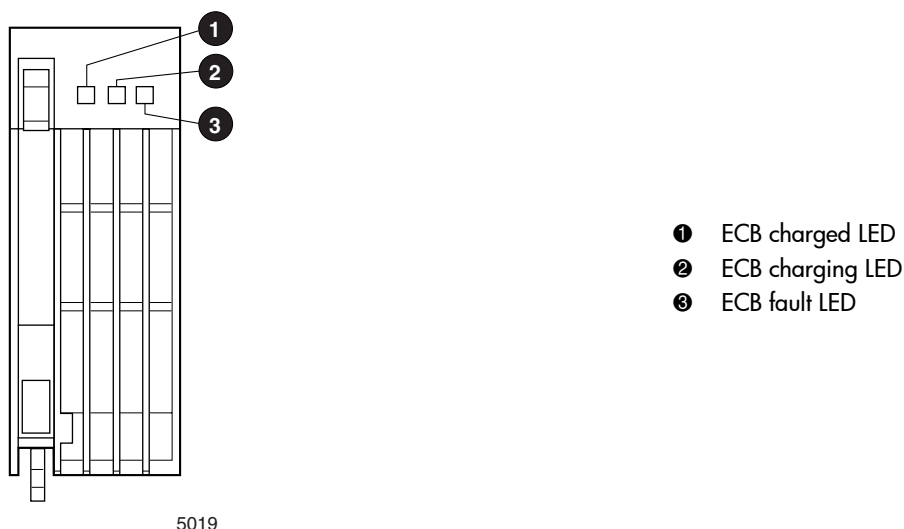


Figure 64: ECB status LEDs

- c. Remove the old ECB and install the blank bezel in this vacant bay.
- d. Proceed to [step 7](#) on page 154.
6. Replace the ECB:

Note: Do not wait for the battery status light on the replacement ECB to turn solid green.

- For a single ECB:
 - a. Remove the old ECB and insert the replacement ECB into the same location.
 - b. Connect the replacement ECB to the open end of the ECB Y-cable attached to the old ECB, and then quickly disconnect the Y-cable from the old ECB.
- For dual ECBs:
 - a. Connect the replacement ECB to the open end of the ECB Y-cable attached to the old ECB, and then quickly disconnect the Y-cable from the old ECB.
 - b. Place the replacement dual ECB in a temporary location.

7. Press **Enter** or **Return**.

The ECB expiration date and deep discharge history are updated. *FRUTIL* exits.

8. If you are replacing the ECB for an array controller in a M2200 enclosure, proceed to [step 10](#).
9. For a dual-redundant controller configuration with a dual ECB installed:
 - a. If the “other controller” cache module is also to be connected to the replacement ECB, connect the PC or terminal to the “other controller” maintenance port.

The connected array controller now becomes “this controller.”
 - b. Repeat [step 3](#) (starting on page 151) through [step 7](#).
 - c. Remove the old dual ECB and place the replacement ECB in that location.
10. Disconnect the PC or terminal from the array controller maintenance port.
11. If you are replacing the ECB for an array controller in a M2200 enclosure, repeat [step 1](#) (on page 151) through [step 9](#) to replace another ECB for the “other controller” in a dual-redundant controller configuration.

Replacing an ECB with the BA370 subsystem powered off

Use the following steps to replace the ECB with the BA370 subsystem powered off:

Note: You can replace the ECB storage building block (SBB) while the storage system is shut down by taking the following actions. First, issue the `SET NOFAILOVER CLI` command from the operational controller. This takes the units and moves them from the controller that is to be replaced to the operational controller. Second, shut down the controller to be replaced by entering the `SHUTDOWN THIS_CONTROLLER CLI` command from each controller prior to shutting down the controller. These commands instruct the array controllers to flush all unwritten data from the cache modules and discontinue all I/O activity.

1. If the HSG60 or HSG80 array controller and cache module are not operating, go to [step 4](#) on page 156. Otherwise, proceed to [step 2](#).
2. Connect a PC or terminal to the maintenance port of the operational array controller.

The controller connected to the PC or terminal becomes “this controller;” the second controller becomes the “other controller.”

3. Shut down the array controllers.
 - In single-controller configurations, shut down “this controller” with the following command:

```
SHUTDOWN THIS_CONTROLLER
```

- In dual-redundant controller configurations, shut down the “other controller” first, then shut down “this controller” with the following commands:

```
SHUTDOWN OTHER_CONTROLLER
SHUTDOWN THIS_CONTROLLER
```

Note: After the array controllers shut down, the **Reset** buttons and the first three LEDs turn on (see [Figure 38](#) on page 102). This procedure takes several minutes, depending on the amount of data that needs to be flushed from the cache modules. Proceed only after the **Reset** buttons stop flashing and remain solid.

4. Remove power to the subsystem by turning off both AC input boxes for all BA370 enclosures, and then disable the ECBs.



Caution: The ECB cable has a 12-volt and a 5-volt pin. Improper handling or misalignment while connecting or disconnecting it can cause these pins to contact ground, resulting in cache module damage.

5. Replace the ECB:
 - For a single ECB:
 - a. Remove the old ECB and insert the replacement ECB into the same location.
 - b. Connect the replacement ECB to the open end of the ECB Y-cable attached to the old ECB, and then quickly disconnect the Y-cable from the old ECB.
 - For dual ECBs:
 - a. Connect the replacement ECB to the open end of the ECB Y-cable attached to the old ECB, and then quickly disconnect the Y-cable from the old ECB.
 - b. Place the replacement dual ECB in a temporary location.
6. Restore power to the subsystem.

The controllers automatically restart.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

Note: If the controller did not restart, press the **Reset** button.

7. Set the controller time.
8. Start *FRUTIL* with the following command:

```
RUN FRUTIL
```
9. Enter **Y(es)** to confirm the intent to replace the “this controller” ECB with power off.

10. Press **Enter** or **Return**.

The ECB expiration date and deep discharge history are updated.

FRUTIL exits.

11. For dual-redundant controller configurations, complete the following substeps to replace the ECB for both cache modules:

- a. If the “other controller” cache module is also to be connected to the replacement ECB, connect the PC or terminal to the “other controller” maintenance port.

The connected controller now becomes “this controller.”

- b. Repeat [step 2](#) (on page 155) through [step 10](#).
- c. For dual ECB configurations, remove the old dual ECB and place the replacement ECB in that location.

12. Disconnect the PC or terminal from the controller maintenance port.

Replacing a PVA module

Use the following steps to replace a PVA module in a master enclosure or expansion enclosure. The master enclosure contains array controllers and cache modules; expansion enclosures do not.

Note: Array controllers can support up to three BA370 enclosures: a master enclosure and two expansion enclosures.

A PVA can be replaced in either a single-controller or a dual-redundant controller configuration using this procedure.

1. Connect a PC or terminal to the maintenance port of the operational controller.

The controller connected to the PC or terminal becomes “this controller,” and the second controller becomes the “other controller.”

2. In a dual-redundant controller configuration, disable Failover and take the array controllers out of dual-redundant configuration with one of the following commands:

```
SET NOFAILOVER
```

or

```
SET NOMULTIBUS_FAILOVER
```

3. Start *FRUTIL* with the following command:

```
RUN FRUTIL
```

4. Enter **N(o)** to the question about replacing the cache battery.
5. Enter **3** for the replace the PVA option.

Note: The *FRUTIL* PVA replacement menu provides options for three enclosures regardless of how many enclosures are actually connected.

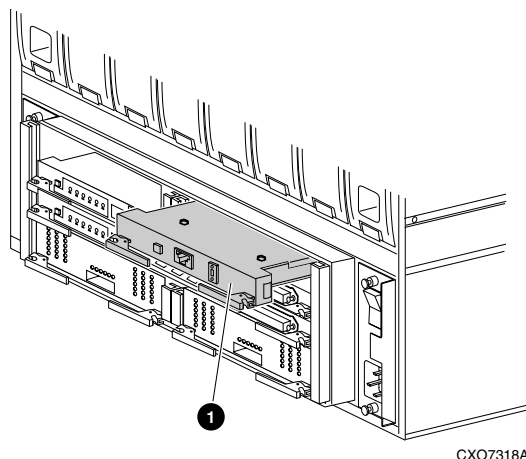
6. Select *one* of the following options:
 - Enter **1** to replace the PVA in a master enclosure.
 - Enter **2** to replace the PVA in the first expansion enclosure.
 - Enter **3** to replace the PVA in the second expansion enclosure.

7. Enter **Y(es)** to confirm the intent to install the PVA module.
8. Set the replacement PVA SCSI ID address:
 - Set to 0 for a master enclosure.
 - Set to 2 for the first expansion enclosure.
 - Set to 3 for the second expansion enclosure.
9. Press **Enter** or **Return**.



Caution: Wait for *FRUTIL* to quiesce the device ports—indicated by an *All device ports quiesced* message. Failure to allow the ports to quiesce can result in data loss. Quiescing can take several minutes.

10. Replace the PVA:
 - a. Disengage both retaining levers on the old PVA (see [Figure 65](#)) and remove the PVA.



❶ PVA module

Figure 65: PVA module location



Caution: Carefully align the replacement PVA in the appropriate guide rails. Misaligning the module can damage the backplane.

- b. Insert the replacement PVA and engage both retaining levers.
11. Press **Enter** or **Return** to resume device port activity, and then restart the “other controller.”

Note: A controller restart is indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

12. If the “other controller” did not restart, press the **Reset** button on the “other controller.”
13. Enable Failover and re-establish the dual-redundant configuration with one of the following commands:

```
SET FAILOVER COPY=THIS_CONTROLLER
```

or

```
SET MULTIBUS_FAILOVER COPY=THIS_CONTROLLER
```

This command copies the subsystem configuration from “this controller” to the “other controller.”

14. If desired, verify the failover configuration with the following command:

```
SHOW THIS_CONTROLLER FULL
```

15. Disconnect the PC or terminal from the controller maintenance port.

Replacing an I/O module

Figure 66 shows a rear view of the BA370 enclosure and the relative location of the six I/O modules (also referred to as ports). Figure 67 shows the six I/O modules, the location of the connectors and securing screws, and a bay-to-bus numbering correlation.

Note: An I/O module can be replaced in either a single-controller or a dual-redundant controller configuration using this procedure.

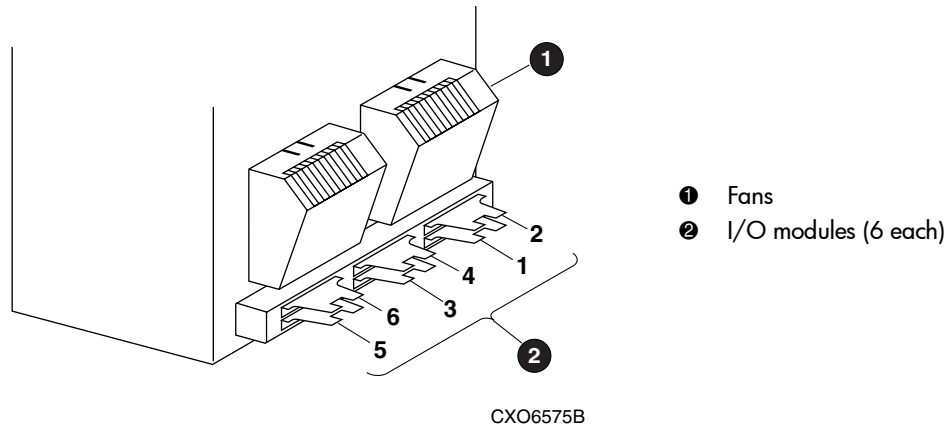


Figure 66: I/O module locations in a BA370 enclosure

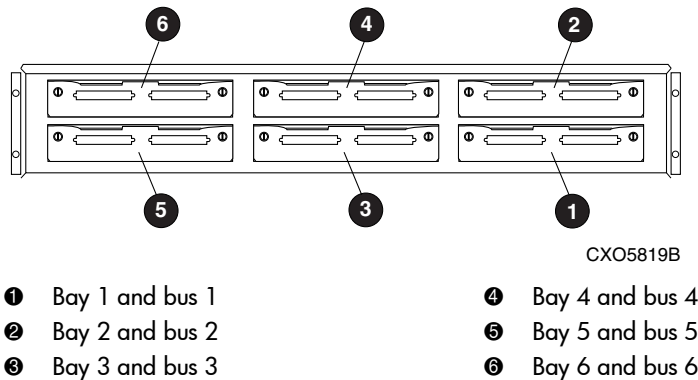


Figure 67: I/O module bay and bus numbering in a BA370 enclosure

Note: The array controller can function with one failed I/O module.

Use the following steps to replace an I/O module:

1. Connect a PC or terminal to the maintenance port of an operational controller.
2. In a dual-redundant controller configuration, disable Failover and take the controllers out of dual-redundant configuration with one of the following commands:

```
SET NOFAILOVER
```

or

```
SET NOMULTIBUS_FAILOVER
```

3. Start *FRUTIL* by entering the following command:

```
RUN FRUTIL
```

4. Enter **N(o)** to the question about replacing the cache battery.

Note: The array controller supports up to three enclosures. The I/O module status can show the following states:

- Single Ended-OK
 - Differential-OK
 - Termination only-OK
 - Missing or bad
 - Unknown or bad
 - N/A (cabinet is not present)
-

5. Enter option **4** to replace an I/O module. The example in [Figure 68](#) shows the generated I/O module status display and indicates cabinet 0, port 5 as missing or bad.

I/O Module Status:			
	Cabinet 0	Cabinet 2	Cabinet 3
	-----	-----	-----
Port 1:	Single Ended - OK	N/A	N/A
Port 2:	Single Ended - OK	N/A	N/A
Port 3:	Single Ended - OK	N/A	N/A
Port 4:	Single Ended - OK	N/A	N/A
Port 5:	Missing or bad	N/A	N/A
Port 6:	Single Ended - OK	N/A	N/A
Is the replacement I/O module available? Y/N			

Figure 68: Sample I/O module status display

6. Enter **Y**(es) to confirm the intent to replace the I/O module.



Caution: Wait for *FRUTIL* to quiesce the device ports—indicated by an All device ports quiesced message. Failure to allow the ports to quiesce can result in data loss. Quiescing can take several minutes.

If the incorrect I/O module is removed, the array controller becomes inoperable. Data loss may occur.

7. Replace the appropriate I/O module (see [Figure 67](#) on page 161):
 - a. Disconnect all bus cables from the I/O module.
 - b. Remove the failed I/O module.
 - c. Install a replacement I/O module.
 - d. Reconnect all bus cables to the I/O module.
8. Press **Enter** or **Return** to resume device port activity and restart the “other controller.”

Note: A controller restart is indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

Note: If the “other controller” did not restart, press the **Reset** button.

9. Enable Failover and re-establish the dual-redundant configuration with one of the following commands:

```
SET FAILOVER COPY=THIS_CONTROLLER
```

or

```
SET MULTIBUS_FAILOVER COPY=THIS_CONTROLLER
```

This command copies the subsystem configuration from “this controller” to the “other controller.”

10. If desired, verify the failover configuration with the following command:

```
SHOW THIS_CONTROLLER FULL
```

11. Disconnect the PC or terminal from the controller maintenance port.

Handling a failed DIMM

If a DIMM fails, ACS displays the message shown in [Figure 69](#). If a DIMM failure occurs, note which DIMM needs replacement based on the display.

```
1.%CER--DebugTop> --18-MAY-2004 10:50:47-- Cache module DIMM 2
failed
2.%EVL--DebugTop> --18-MAY-2004 10:50:58-- Instance Code: 02623801
(not yet reported to host)
DIMM      Instance Code
DIMM-1 = 02613801
DIMM-2 = 02623801
DIMM-3 = 02633801
DIMM-4 = 02643801
```

Figure 69: CLI screen display indicating which DIMM failed

Also see the *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Troubleshooting Guide* for cache policy information to determine which cache module and DIMM are at fault.

Additional information is available in the section entitled, “[Upgrading cache memory](#)” which starts on page 245.

Upgrading the Subsystem

4

This chapter provides the following instructions:

- [Upgrading from ACS V8.6-x and V8.7-x to V8.8](#), page 168
- [After-upgrade maintenance checks](#), page 213
- [Downgrading ACS V8.8-x to V8.6-1 or V8.7-1](#), page 226
- [Installing, deleting, and listing software patches by using CLCP](#), page 231
- [Upgrading firmware on a device](#), page 239
- [Upgrading to a dual-redundant controller configuration](#), page 242
- [Upgrading cache memory](#), page 245



Caution: See the “[Prerequisites](#)” section that starts on page 14 and the “[Common Replacement Information and Procedures](#)” chapter that starts on page 45 to review the list of required tools and the precautions to follow prior to performing procedures within this chapter.

Upgrading from ACS V8.6-x and V8.7-x to V8.8

This section covers the following topics:

- [Upgrading controller software](#), page 168
- [Upgrading the software image](#), page 169
- [Upgrading to ACS V8.8-xF, V8.8-xG, V8.8-xL, and V8.8-xS](#), page 171
 - [Rolling upgrade procedure for dual-redundant configurations](#), page 171
 - [Shutdown upgrade procedure for dual-redundant and single-controller configurations](#), page 181
- [Upgrading to ACS V8.8-xP software](#), page 186
 - [Rolling upgrade procedures for DRM configurations](#), page 186
 - [Shutdown upgrade procedures for DRM configurations](#), page 203

Upgrading controller software

Upgrading controller software involves installing a new program card (see [Figure 70](#)) that contains the new software. The following figure illustrates how to remove and install the ACS firmware, *or* PCMCIA, card. Use [Figure 70](#) for reference throughout the following subsections.

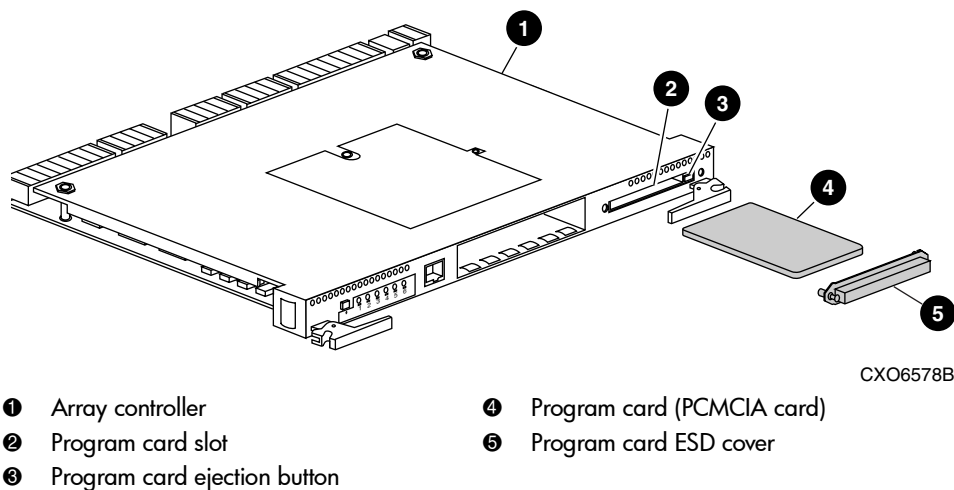


Figure 70: Program card (PCMCIA card) installation

Upgrading the software image

This section describes the supported upgrade methods and procedures required to successfully upgrade the array controller ACS firmware from V8.6-*x* or V8.7-*x* to V8.8-*x*. ACS V8.8-*x* supports both dual-redundant controller rolling upgrade and dual-redundant controller shutdown upgrade methods. The rolling upgrade method allows the host system to continue I/O activity, with minimal impact, while each controller is upgraded. The shutdown upgrade method takes the storage devices offline for a period of time while the software is upgraded simultaneously on both controllers.



Caution: Failure to follow these upgrade procedures can result in the loss of data, or the controller can be left in an unusable state. Completely read and understand all of the required steps prior to upgrading.

Do not use the procedures in this guide in an attempt to upgrade from ACS V8.4 or 8.5 (or any other unsupported version) to ACS V8.8-*x*. Significant downtime and data loss can result.

Note: *Rolling upgrades* are supported if you are upgrading by using any of the following scenarios:

- V8.6-*xF* or V8.7-*xF* to V8.8-*xF*, V8.8-*XS*, or V8.8-*xP*
- V8.6-*xG* or V8.7-*xG* to V8.8-*xG*, V8.8-*xF*, V8.8-*XS*, or V8.8-*xP*
- V8.6-*XS* or V8.7-*XS* to V8.8-*XS* or V8.8-*xP*
- V8.6-*xP* or V8.7-*xP* to V8.8-*xP*
- V8.6-*XL* or V8.7-*XL* to V8.8-*XL*

Shutdown upgrades are supported when transitioning from any ACS version supported by rolling upgrades, plus the following:

- V8.6-*xF* or V8.7-*xF* to V8.8-*xF*, V8.8-*XS*, or V8.8-*xP*
- V8.6-*xG* or V8.7-*xG* to V8.8-*xG*, V8.8-*xF*, V8.8-*XS*, or V8.8-*xP*
- V8.6-*XS* or V8.7-*XS* to V8.8-*XS* or V8.8-*xP*
- V8.6-*xP* or V8.7-*xP* to V8.8-*xP*
- V8.6-*XL* or V8.7-*XL* to V8.8-*XL*
- V8.6-*XS* or V8.7-*XS* to V8.8-*xF* or V8.8-*xG*
- V8.6-*xP* or V8.7-*xP* to V8.8-*XS*

Any other ACS version upgrade is *not* supported.

Before upgrading, determine which version of ACS is currently in use (by issuing a `SHOW THIS CONTROLLER` and `SHOW OTHER CONTROLLER` command, as applicable, from a CLI prompt), and then determine which upgrade method to use:

- **Rolling Upgrade**—This method allows I/O activity to continue during the upgrade by using the failover capabilities of the controllers. Only one controller at a time is shut down to perform the upgrade, allowing the host system full access to the disk devices during the upgrade with minimal impact to the host systems.

Note: Rolling upgrades between different ACS variants are not supported in Microsoft Windows. If you need to upgrade from one variant of ACS to another, you must perform a shutdown upgrade and reboot the controller.



Caution: IBM AIX users must use shutdown upgrade procedures only. Rolling upgrades are not recommended on IBM AIX platforms.



Caution: If you are upgrading to ACS 8.8-xP (HP StorageWorks Data Replication Manager), note the following guidelines:

- Ensure that the latest drivers and that SecurePath V3.0A (Service Pack 1) or SecurePath V3.0B (Service Pack 1) are installed before upgrading.
- Complete a shutdown upgrade if you are running Windows NT, Windows 2000, or IBM AIX. Rolling upgrades are not supported on these platforms.

Failure to follow these guidelines can result in undesirable controller upgrade issues.

- **Shutdown Upgrade**—This method requires the halting of I/O activity to the controllers during the upgrade. Both controllers are shut down during the upgrade procedure. Units are not available to the host system during this time. Before upgrading the controller software, dismount units on the host system or shut down the host system.

After determining the upgrade method, carefully follow the appropriate procedure.



Caution: Windows users who are upgrading their firmware version should perform the following steps during the upgrade process:

- a. Shut down the host system.
- b. Perform a shutdown upgrade of the controllers.
- c. Restart the host system.

Failure to perform the above actions prevents units from being presented with the original disk letter and can cause you to lose access to unit data.

Upgrading to ACS V8.8-xF, V8.8-xG, V8.8-xL, and V8.8-xS

Use this section only if you are upgrading to ACS V8.8-xF, V8.8-xG, V8.8-xL, and V8.8-xS. Upgrade ACS V8.8-xP by using the procedures in the [“Upgrading to ACS V8.8-xP software”](#) section which starts on page 186.

Tip: If your site currently uses V8.6-xP but is not configured for DRM (single-controller or dual-controller set to *NOREMOTE_COPY*), you can upgrade the controller to V8.8-xP by using the procedure in this section ([“Upgrading to ACS V8.8-xF, V8.8-xG, V8.8-xL, and V8.8-xS”](#) on page 171). In this instance, treat the upgrade as though it were for V8.8-xS to ensure that the Snapshot unit procedure steps are done.

Rolling upgrade procedure for dual-redundant configurations

This upgrade procedure applies only to dual-redundant controller configurations and allows the disk units to be accessible to connected hosts during the upgrade with minimal disruption. For single-controller configurations, see the [“Shutdown upgrade procedure for dual-redundant and single-controller configurations”](#) section that starts on page 181. Specific controllers are referred to as controller A or controller B during the procedure. For clarity, the CLI prompts illustrated in the procedure use *HSGA>* and *HSGB>* to indicate which controller (A or B) is used.

Note: Before initiating an ACS rolling upgrade, refer to the appropriate ACS solution software installation and configuration guide for your operating system for additional instructions. These procedures include considerations for solution software, HP StorageWorks Secure Path, and switch firmware, as well as controller-based upgrades. Specific instructions for the solution software and the proper sequence for all components are included.

Note: The following steps *must* be followed carefully for the upgrade to work properly. This procedure takes approximately 5 to 10 minutes depending upon the complexity of the configuration. If you are upgrading from V8.6-x, the units involved are briefly unavailable twice during the procedures for approximately 10 to 20 seconds in [step 21](#) on page 178 and [step 26](#) on page 179.



Caution: Before upgrading, verify that the subsystem is in a stable state. This can be verified by examining the controller **Reset** button and the adjacent LEDs. The **Reset** buttons should be flashing. All adjacent LEDs should be off (no light). Also, verify that the controller is not reporting a lot of event information. Issue a `SHOW THIS CONTROLLER` CLI command from each involved controllers to ensure controllers are responding to CLI commands as well. Failure to perform this verification can result in data loss or leave the controller in an unusable state.

Note: If you have several servers with multiple LUNs in your storage area network (SAN) and are using HP StorageWorks Secure Path Manager, HP recommends that you verify that all units are online by using the `SHOW UNITS FULL` CLI command. Afterwards, move all LUNs to the controller to be updated last by using HP StorageWorks Secure Path Manager. (LUNs may be moved by either controller.)

Use the following procedures to perform the rolling upgrade:

1. Connect a PC or terminal to the maintenance port of controller A.
-



Caution: Each controller in a dual-redundant configuration should be at least 50% idle before attempting a rolling upgrade. Failure to do so can result in jobs being dropped during the upgrade.

2. Run the *Virtual Terminal Display (VTDPY)* utility to verify the utilization of *each* controller by entering the following:

```
HSGA> RUN VTDPY
```

The controller percent idle is the first item displayed on the second line of the *VTDPY* display.

3. If the controller is less than 50% idle, reduce the processing load.

Note: The *VTDPY* display refreshes every ten seconds.

4. Press **Ctrl+C** and then enter the following command to exit *VTDPY*:

```
VTDPY> EXIT
```

5. Temporarily, move the PC or terminal to the maintenance port of controller B to repeat [step 2](#) through [step 4](#) on controller B.
6. Return PC or terminal to the maintenance port of controller A.
7. If the controller is running in SCSI-2 mode and the Command Console LUN (CCL) is enabled, you must disable the CCL prior to upgrading:
 - a. Determine if the controller is in SCSI-2 mode and the CCL is enabled by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```

[Figure 71](#) shows only a portion of the resulting display—arrows point to the pertinent status indication.

Controller:

```
HSG80                (C) DEC ZG80200258 Software V88S,
                      Hardware E01
```

```
NODE_ID              = 5000-1FE1-0007-B780
```

```
ALLOCATION_CLASS      = 1
```



```
SCSI_VERSION         = SCSI-2
```

```
Configured for MULTIBUS_FAILOVER with ZG92810098
```

```
          In dual-redundant configuration
```

```
Device Port SCSI address 7
```

```
Time: 14-Mar-2005    15:44:25
```



```
Command Console LUN is lun 0 (IDENTIFIER = 0)
```

Figure 71: Screen display indicating SCSI version and CCL setting

- b. If the controller is in SCSI-2 mode and the CCL is enabled, record the status for restoration in [step 35](#) on page 181.
- c. Disable the CCL by entering the following command:

```
HSGA> SET THIS_CONTROLLER NOCOMMAND_CONSOLE_LUN
```

8. If upgrading from ACS V8.6-xS or 8.7-xS, delete all Snapshot units:

- a. Identify all Snapshot units by entering the following command:

```
HSGA> SHOW UNITS FULL
```

- b. Record the configuration for each Snapshot unit for restoration in [step 34](#) on page 181.

- c. Individually delete all Snapshot units by entering the following command:

```
HSGA> DELETE snapshot-unit-name
```

- d. Verify that all appropriate Snapshot units were deleted by entering the following command:

```
HSGA> SHOW UNITS FULL
```

Note: If any Snapshot unit exists, repeat [step 8](#) on page 174.

9. Identify and record the current cache flush timer value of the “this controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:

```
HSGA> SHOW THIS_CONTROLLER
```

[Figure 72](#) shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
      256 megabyte write cache, version 0022
      Cache is GOOD
      No unflushed data in cache
      →  CACHE_FLUSH_TIMER=DEFAULT (10 seconds)
```

Figure 72: Screen display indicating cache flush timer value

10. Identify and record the current cache flush timer value of the “other controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:

```
HSGA> SHOW OTHER_CONTROLLER
```

Note: The cache flush timer value is displayed in the caching parameters section. This parameter is modified during the procedure and must be restored later in this procedure.

11. For each unit, identify and record the unit writeback, read ahead, read, and preferred path characteristics by entering the following command:

```
HSGA> SHOW UNITS FULL
```

These characteristics are modified during the upgrade procedure and must be restored in [step 32](#) on page 180.

Note: The *PREFERRED_PATH* switch is only available with a multiple-bus configuration. It is not available in the Transparent Failover mode.

12. Set the cache flush timer to 1 second by entering the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=1
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=1
```

13. Clear any unit with *PREFERRED_PATH* set, by entering the following command as required for each unit:

```
HSGA> SET unit-name NOPREFERRED_PATH
```

14. Disable writeback, read ahead, and read caching on all units by entering the following command as required for each unit:

```
HSGA> SET unit-name NOWRITEBACK_CACHE NOREADAHEAD_CACHE
NOREAD_CACHE
```

Note: The *XXX_CACHE* switches must be entered in the specified order or the command is rejected.

15. Determine if all data is flushed from the cache module by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```

Figure 73 shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
      256 megabyte write cache, version 0022
→      Cache is GOOD
→      No unflushed data in cache
      CACHE_FLUSH_TIMER=1 SECOND
```

Figure 73: Screen display indicating cache status and whether data remains in cache

Note: Repeat [step 15](#) (on page 175) on both controllers (“this controller” and the “other controller”) until no unwritten data remains in either cache module memory. If unwritten data is present after several minutes, verify that writeback cache was disabled on all units by using the `SHOW UNITS FULL` command. For any unit with writeback cache enabled, return to [step 14](#) (on page 175) and proceed.

16. Shut down controller B by entering the following command:

```
HSGA> SHUTDOWN OTHER_CONTROLLER
```

Note: Disregard any messages pertaining to misconfigured controllers or failover status.

Note: After controller B shuts down, the **Reset** button and the first three LEDs turn on (see [Figure 74](#)).

Proceed only after the **Reset** button stops flashing and remains on.

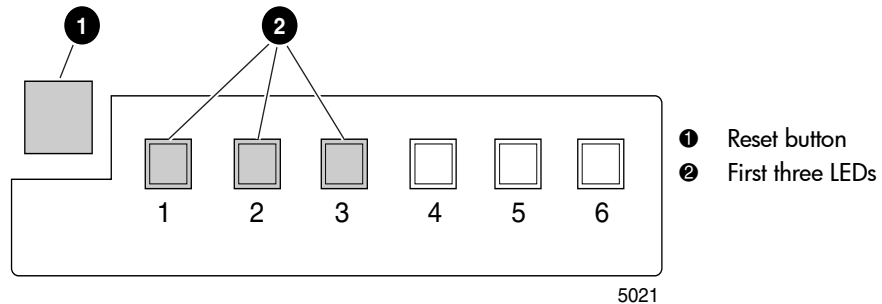


Figure 74: Reset button and first three LEDs

17. Verify that all units failed over to controller A by entering the following command to show the status of each unit:

```
HSGA> SHOW UNITS FULL
```

Figure 75 shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
State:
  → ONLINE to this controller
    Not reserved
    NOPREFERRED_PATH
```

Figure 75: Screen display indicating unit online status

18. Run *VTDPY* to verify that all units are online and that expected I/O activity is resumed by entering the following command:

```
HSGA> RUN VTDPY
```

19. Wait a minimum of 60 seconds to allow the unit to fail over and the resumption of expected I/O as seen for used units under the KB/S column of the display. The unit online status is indicated by an O under the ASWC column of the display.

20. Exit *VTDPY* by pressing **Ctrl+C**, and then enter the following command:

```
VTDPY> EXIT
```

Note: In [step 21](#) and [step 22](#) (on page 179), controller B is updated first. After controller B restarts, it automatically shuts down controller A if you are upgrading from ACS V8.6-*x* to V8.8-*x*. If you are upgrading from ACS V8.7-*x* to V8.8-*x*, manually shut down controller A by entering the `SHUTDOWN OTHER_CONTROLLER` command.

21. Upgrade the software on controller B by performing the following substeps:

Note: After [step 21](#) is successfully performed, the previous ACS version cannot be restored to this subsystem.

- a. Remove the program card ESD cover from controller B.
- b. Press and hold the controller **Reset** button while ejecting the old program card.
- c. After ejecting the program card, release the **Reset** button.
- d. Press and hold the **Reset** button while inserting the new program card.

- e. After the card is fully inserted, release the button. Controller B restarts.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button. Disregard messages pertaining to misconfigured controllers or failover status.

- f. Install the program card ESD cover on controller B.
22. Verify that controller B completed initialization by completing the following substeps:
 - a. Connect the PC or terminal to the maintenance port of controller B.
 - b. Verify that the CLI prompt for controller B is displayed.

Note: Wait for the CLI prompt before proceeding.

- c. Perform one of the following options:
 - If you are upgrading from ACS V8.6-x to V8.8-x, verify controller A is shut down and that the **Reset** button and the first three LEDs turn on (See [Figure 74](#) on page 177). Proceed only after the **Reset** button stops flashing and remains on.
 - If you are upgrading from ACS V8.7-x to V8.8-x, shut down controller A with the following CLI command:


```
HSGB> SHUTDOWN OTHER_CONTROLLER
```
23. Run *VTDPY* to verify that all units are online and that expected I/O activity is resumed by entering the following command:


```
HSGB> RUN VTDPY
```
24. Wait a minimum of 60 seconds to allow the unit to fail over and the resumption of expected I/O as seen for used units under the KB/S column of the display. The unit online status is indicated by an O under the ASWC column of the display.
25. Exit *VTDPY* by pressing **Ctrl+C**, and then enter the following command:


```
VTDPY> EXIT
```
26. Upgrade the software on controller A by performing the following substeps:
 - a. Remove the program card ESD cover from controller A.

- b. Press and hold the controller **Reset** button while ejecting the old program card.
- c. After ejecting the program card, release the **Reset** button.
- d. Press and hold the **Reset** button while inserting the new program card.
- e. After the card is fully inserted, release the **Reset** button.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of port LEDs and a flashing **Reset** button. Disregard messages pertaining to misconfigured controllers or failover status.

- f. Install the program card ESD cover on controller A.
27. Connect a PC or terminal to the maintenance port of controller A.
28. After controller A restarts, restore the `CACHE_FLUSH_TIMER` to the values recorded in [step 9](#) and [step 10](#) on page 174 by entering the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=n
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=n
```

29. Verify that the `CACHE_FLUSH_TIMER` values have been updated:

```
HSGA> SHOW THIS_CONTROLLER
HSGA> SHOW OTHER_CONTROLLER
```

30. For each unit, restore the preferred path setting as recorded in [step 13](#) on page 175 by entering the following command:

```
HSGA> SET unit-name PREFERRED_PATH=THIS_CONTROLLER
```

or

```
HSGA> SET unit-name PREFERRED_PATH=OTHER_CONTROLLER
```

31. After updating cache settings for each unit, verify the change:

```
HSGA> SHOW unit-name
```

32. For each unit, restore the cache settings as recorded in [step 11](#) on page 175 by entering the following command:

```
HSGA> SET unit-name READ_CACHE READAHEAD_CACHE WRITEBACK_CACHE
```

33. After updating the cache setting for each unit, verify the change:

```
HSGA> SHOW unit-name
```

Note: If I/O activity is congested, additional time may be required for cache settings to completely restore.

34. Restore all Snapshot units removed in [step 8](#) on page 174.
35. If the CCL was disabled in [step 7](#) on page 173, enable it by entering the following command:

```
HSGA> SET THIS_CONTROLLER COMMAND_CONSOLE_LUN
```
36. Verify that the CCL setting was restored by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```
37. Disconnect the PC or terminal from the maintenance port of controller A.
38. Refer to the “[After-upgrade maintenance checks](#)” section (on page 213) for additional after-upgrade steps if you are upgrading from ACS V8.7-2 or later.

Shutdown upgrade procedure for dual-redundant and single-controller configurations

This upgrade procedure applies to dual-redundant controller configurations and single-controller configurations. Specific controllers are referred to as controller A or controller B during the procedure. For clarity, the CLI prompts illustrated in this procedure use *HSGA>* and *HSGB>* to indicate which controller (A or B) is used.

Note: The following steps *must* be followed carefully for the upgrade to work properly. The procedure takes approximately five minutes.

Use the following procedures to perform a shutdown upgrade:



Caution: Before upgrading, verify that the subsystem is in a stable state. This can be verified by examining the controller **Reset** button and the adjacent LEDs. The **Reset** buttons should be flashing. All adjacent LEDs should be off (no light). Also, verify that the controller is not reporting a lot of event information. Issue a `SHOW THIS CONTROLLER` CLI command from each involved controllers to ensure controllers are responding to CLI commands as well. Failure to perform this verification can result in data loss or leave the controller in an unusable state.

Note: This procedure is written for dual-redundant controller configurations. If upgrading a single-controller configuration, disregard references to multiple controllers and controller B.

1. From a host console, stop all host activity to the controllers and dismount the logical units in the subsystem.
2. Connect a PC or terminal to the maintenance port of controller A.
3. If the controller is running in SCSI-2 mode and the CCL is enabled, you must disable the CCL prior to upgrading by performing the follow substeps:
 - a. Determine if the controller is in SCSI-2 mode and the CCL is enabled by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```

Figure 76 shows only a portion of the resulting display—arrows point to the pertinent status indication.

Controller:

```

HSG80                      (C) DEC ZG80200258 Software V88P,
                           Hardware E01 [[Does DEC still display?]]

NODE_ID                    = 5000-1FE1-0007-B780
ALLOCATION_CLASS             = 1
→ SCSI_VERSION              = SCSI-2
Configured for MULTIBUS_FAILOVER with ZG92810098
                           In dual-redundant configuration
Device Port SCSI address 7
Time: 14-Mar-2005          15:44:25
→ Command Console LUN is lun 0 (IDENTIFIER = 0)
```

Figure 76: Screen display indicating SCSI version and CCL setting

- b. If the controller is in SCSI-2 mode and the CCL is enabled, record the status for restoration in [step 14](#) on page 185.
- c. Disable the CCL by entering the following command:

```
HSGA> SET THIS_CONTROLLER NOCOMMAND_CONSOLE_LUN
```

4. If upgrading from ACS V8.6-xS OR V8.7-xS, delete all Snapshot units by performing the following substeps:

- a. Identify all Snapshot units by entering the following command:

```
HSGA> SHOW UNITS FULL
```

- b. Record the configuration for each Snapshot unit for restoration in [step 13](#) on page 185.

- c. Individually delete all Snapshot units by entering the following command:

```
HSGA> DELETE snapshot-unit-name
```

- d. Verify that all appropriate units were deleted by entering the following command:

```
HSGA> SHOW UNITS FULL
```

Note: If any Snapshot unit exists, repeat [step 4](#).

5. Identify and record the current cache flush timer value of the “this controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:

```
HSGA> SHOW THIS_CONTROLLER
```

[Figure 77](#) shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
    256 megabyte write cache, version 0022
    Cache is GOOD
    No unflushed data in cache
    → CACHE_FLUSH_TIMER=DEFAULT (10 seconds)
```

Figure 77: Screen display indicating cache flush timer value

6. Identify and record the current cache flush timer value of the “other controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:

```
HSGA> SHOW OTHER_CONTROLLER
```

Note: The cache flush timer value is displayed in the caching parameters section. This parameter is modified during the procedure and must be restored later in this procedure.

7. Set the `CACHE_FLUSH_TIMER` to 1 second by entering the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=1
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=1
```

8. Determine if all data is flushed from the cache module by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```

Figure 78 shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
      256 megabyte write cache, version 0022
      Cache is GOOD
      → No unflushed data in cache
      CACHE_FLUSH_TIMER=1 SECOND
```

Figure 78: Screen display indicating whether all data is flushed from the system

Note: Repeat [step 8](#) on both controllers (“this controller” and the “other controller”) until no unwritten data remains in either cache module memory.

9. Shut down both controllers by entering the following commands:

```
HSGA> SHUTDOWN OTHER_CONTROLLER
HSGA> SHUTDOWN THIS_CONTROLLER
```

Note: After the controllers shut down, the **Reset** buttons and the first three LEDs turn on (see [Figure 74](#) on page 177). Proceed only after the **Reset** buttons stop flashing and remain solid.

10. Upgrade the software on both controllers by performing the following substeps:
 - a. Remove the program card ESD cover from controller A.
 - b. Press and hold the **Reset** button while ejecting the old program card.
 - c. After the program card is ejected, release the **Reset** button.
 - d. Repeat [substep a](#) through [substep c](#) for controller B.

Note: In [substep e](#) and [substep f](#), the simultaneous release of the **Reset** buttons is critical to ensure that both controllers are restarted and upgraded simultaneously.

- e. Simultaneously press and hold the **Reset** button on both controllers, and then insert a new program card into each controller.
- f. Simultaneously release the **Reset** buttons.
Both controllers restart.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button.

- g. Install a program card ESD cover on each controller.
11. After the controllers restart, restore the cache flush timer to the values recorded in [step 5](#) on page 183 by entering the following commands:

```
HSGB> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=n
HSGB> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=n
```
 12. Verify that the CACHE_FLUSH_TIMER values have been updated:

```
HSGA> SHOW THIS_CONTROLLER
HSGA> SHOW OTHER_CONTROLLER
```
 13. Restore all Snapshot units removed in [step 4](#) on page 183.
 14. If the CCL was disabled in [step 3](#) on page 182, enable it by entering the following command:

```
HSGA> SET THIS_CONTROLLER COMMAND_CONSOLE_LUN
```
 15. After enabling the CCL, verify the change:

```
HSGA> SHOW THIS_CONTROLLER
```

16. Mount the logical units on the host.
17. Disconnect the PC or terminal from the maintenance port of controller A.
18. Refer to the “[After-upgrade maintenance checks](#)” section that starts on page 213 for additional after-upgrade steps if you are upgrading from ACS V8.7-2 or later.

Upgrading to ACS V8.8-xP software

ACS V8.8-xP implements the Data Replication Manager (DRM) feature, which can also be upgraded by using either a rolling or shutdown upgrade method. These upgrade methods apply only to dual-redundant controller configurations.

Rolling upgrade procedures for DRM configurations

This rolling upgrade procedure allows the disk units to be accessible to connected hosts during the upgrade process with minimal disruption. Specific controllers are referred to as controller A or controller B during the procedure. For clarity, the CLI prompts illustrated in the procedure use *HSGA>* and *HSGB>* to indicate which controller (A or B) is used.

Note: Before upgrading ACS V8.8-xP, take note of the following details:

- The following steps *must* be followed carefully for the upgrade procedure to work properly. This procedure takes approximately 10 to 20 minutes, depending upon the complexity of the configuration.
 - If you are upgrading from V8.6-x, the units involved are briefly unavailable twice during the procedures for approximately 10 to 20 seconds at each site. (See [step 16](#) on page 193 and [step 21](#) on page 194 for the initiator site. See [step 17](#) on page 199 and [step 22](#) on page 201 for the target site.)
 - HP recommends that no remote copy set normalize, merge, or copy operations be active at the time the upgrade procedures begins.
 - The rolling upgrade procedure upgrades the initiator site controllers to a specific point, and then fully upgrades the target site controllers before finalizing the upgrade for the initiator site controllers.
 - If you have several servers with multiple LUNs in your SAN and are using HP StorageWorks Secure Path Manager, HP recommends that you verify that all units are online by using the `SHOW UNITS FULL` CLI command. Afterwards, move all LUNs to the controller to be updated last by using HP StorageWorks Secure Path Manager. (LUNs may be moved by either controller.)
-



Caution: Before attempting the upgrade procedure, verify that the subsystem is in a stable state. This can be verified by examining the controller **Reset** buttons and the adjacent LEDs. The **Reset** button should be flashing, while all LEDs should be off (no light). Failure to perform this verification can result in data loss or leave the controller in an unusable state.

The following procedure is categorized into four parts. To fully complete the ACS upgrade for V8.8xP, be sure to complete all four parts.

- [Part 1: I/O load verification](#), page 187
- [Part 2: Initiator site upgrade \(initial steps\)](#), page 188
- [Part 3: Target site upgrade](#), page 195
- [Part 4: Initiator site upgrade \(final steps\)](#), page 202

Part 1: I/O load verification

Begin the rolling upgrade by checking the utilization of the initiator and target site controllers:

1. Connect a PC or terminal to the maintenance port of controller A, at the initiator site.



Caution: Each of the four controllers in a DRM configuration (two at the initiator site, two at the target site) should be at least 50% idle before attempting a rolling upgrade. Failure to do so can result in some jobs being dropped during the upgrade.

2. Run *VTDPY* to verify that the utilization of each controller at the site:
 - a. Run *VTDPY* on controller A by entering the following command:

HSGA> RUN VTDPY

The controller percent idle is the first item displayed on the second line of the *VTDPY* display.

- b. If the controller is less than 50% idle, reduce the processing load.

Note: The *VTDPY* display refreshes every ten seconds.

- c. Press **Ctrl+C** and then enter the following command to exit *VTDPY*:
`VTDPY> EXIT`
 - d. Temporarily move the PC or terminal to the maintenance port of controller B.
 - e. Run *VTDPY* on controller B at by entering the following command:
`HSGB> RUN VTDPY`
The controller's percent idle is the first item displayed on the second line of the *VTDPY* display.
 - f. If the controller is less than 50% idle, reduce the processing load.
 - g. Press **Ctrl+C** and then enter the following command to exit *VTDPY*:
`VTDPY> EXIT`
 - h. Return the PC or terminal to the maintenance port of controller A.
3. Verify that a PC or terminal is connected to the maintenance port of controller A at the target site, and repeat [step 2](#) on page 187 at the target site.

Part 2: Initiator site upgrade (initial steps)

Continue the rolling upgrade at the initiator site:

1. Determine if the controller is in SCSI-2 mode and the CCL is enabled by entering the following command:
`HSGA> SHOW THIS_CONTROLLER`

Figure 79 shows only a portion of the resulting display—arrows point to the pertinent status indication.

```

Controller:
HSG80                      (C) DEC ZG80200258 Software V88P,
                           Hardware E01
NODE_ID                    = 5000-1FE1-0007-B780
ALLOCATION_CLASS            = 1
→ SCSI_VERSION             = SCSI-2
Configured for MULTIBUS_FAILOVER with ZG92810098
                           In dual-redundant configuration
Device Port SCSI address 7
Time: 14-Mar-2005         15:44:25
→ Command Console LUN is lun 0 (IDENTIFIER = 0)

```

Figure 79: Screen display indicating SCSI version and CCL setting

2. If the controller is running in SCSI-2 mode and the CCL is enabled, you must disable the CCL prior to upgrading by completing the following substeps:
 - a. If the controller is in SCSI-2 mode and the CCL is enabled, record the status for restoration in [step 6](#) on page 202.
 - b. Disable the CCL by entering the following command:


```
HSGA> SET THIS_CONTROLLER NOCOMMAND_CONSOLE_LUN
```
3. Delete any Snapshot units by entering the following commands:
 - a. Identify all Snapshot units by entering the following command:


```
HSGA> SHOW UNITS FULL
```
 - b. Record the configuration for each Snapshot unit for later restoration.
 - c. Individually delete all Snapshot units and enter the following command:


```
HSGA> DELETE snapshot-unit-name
```
 - d. Verify that all Snapshot units were deleted, and enter the following command:


```
HSGA> SHOW UNITS FULL
```

Note: If any Snapshot unit exists, repeat [step 3](#).

4. Identify and record the current cache flush timer value of the “this controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:

```
HSGA> SHOW THIS_CONTROLLER
```

Figure 80 shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
    256 megabyte write cache, version 0022
    Cache is GOOD
    No unflushed data in cache
    → CACHE_FLUSH_TIMER=DEFAULT (10 seconds)
```

Figure 80: Screen display indicating cache flush timer value

5. Identify and record the current cache flush timer value of the “other controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:

```
HSGA> SHOW OTHER_CONTROLLER
```

Note: The cache flush timer value is displayed in the caching parameters section. This parameter is modified during the procedure and must be restored later in this procedure.

6. For each unit, identify and record the unit writeback cache characteristics by entering the following command:

```
HSGA> SHOW UNITS FULL
```

Note: This is modified during the upgrade procedure and must be restored later.

7. Set the cache flush timer to 1 second by entering the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=1
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=1
```

8. Disable writeback caching on all units by entering the following command as required for each unit:

```
HSGA> SET unit-name NOWRITEBACK_CACHE
```

9. Determine if all data is flushed from the cache module by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```

[Figure 81](#) shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
    256 megabyte write cache, version 0022
    Cache is GOOD
    → No unflushed data in cache
    CACHE_FLUSH_TIMER=1 SECOND
```

Figure 81: Screen display indicating whether flushed data remains in cache

10. Repeat [step 9](#) on both controllers (“this controller” and the “other controller”) until no unwritten data remains in either cache module memory.

Note: If unwritten data is present after several minutes, verify that writeback cache was disabled on all units by using the `SHOW UNITS FULL` command. For any units with writeback cache enabled, return to [step 6](#) on page 190 and proceed.

11. Shut down controller B by entering the following command:

```
HSGA> SHUTDOWN OTHER_CONTROLLER
```

Note: Disregard any messages pertaining to misconfigured controllers or failover status.

Note: After controller B shuts down, the **Reset** button and the first three LEDs turn on (see [Figure 82](#)).

Proceed only after the **Reset** button stops flashing and remains on.

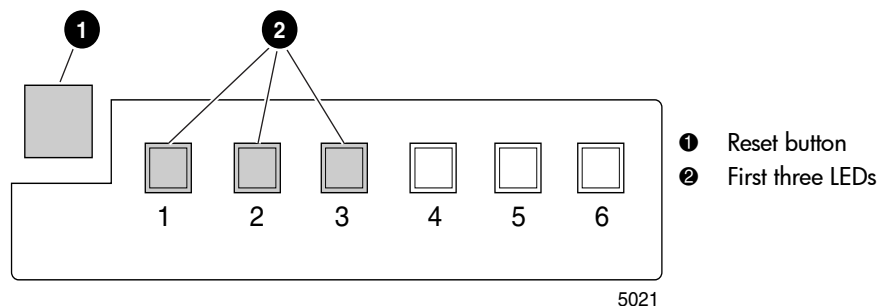


Figure 82: Reset button and first three LEDs

12. Verify that all units failed over to controller A by entering the following command to show the status of each unit:

```
HSGA> SHOW UNITS FULL
```

[Figure 83](#) shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
State:
  → ONLINE to this controller
    Not reserved
```

Figure 83: Screen display indicating online status of the unit

13. Run *VTDPY* to verify that all units are online and that expected I/O activity is resumed by entering the following command:

```
HSGA> RUN VTDPY
```

14. Wait a minimum of 60 seconds to allow the unit to fail over and the resumption of expected I/O as seen for used units under the KB/S column of the display. The unit online status is indicated by an O under the ASWC column of the display.

15. Exit *VTDPY* by pressing **Ctrl+C**, and then enter the following command:

```
VTDPY> EXIT
```

Note: In [step 16](#) and [step 17](#), controller B is updated first. After controller B restarts, it automatically shuts down controller A if you are upgrading from ACS V8.6-*x* to V8.8-*x*. If you are upgrading from ACS V8.7-*x* to V8.8-*x*, manually shut down controller A by entering the `SHUTDOWN OTHER_CONTROLLER` command.

16. Upgrade the software on controller B by performing the following substeps:

Note: After [step 16](#) is performed, the previous ACS version cannot be restored to this subsystem.

- a. Remove the program card ESD cover from controller B.
- b. Press and hold the controller **Reset** button while ejecting the old program card.
- c. After ejecting the program card, release the **Reset** button.
- d. Press and hold the **Reset** button while inserting the new program card.
- e. After the card is fully inserted, release the **Reset** button.

Controller B restarts.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button. Disregard messages pertaining to misconfigured controllers or failover status.

- f. Install the program card ESD cover on controller B.

17. Verify that controller B completed initialization by performing the following substeps:

- a. Connect a PC or terminal to the maintenance port of controller B.
- b. Verify that the CLI prompt for controller B is displayed.

Note: Wait for the CLI prompt before proceeding.

c. Perform one of the following options:

- If you are upgrading from ACS V8.6-*x* to V8.8-*x*, verify controller A is shut down and that the **Reset** button and the first three LEDs turn on (See [Figure 82](#) on page 192). Proceed only after the **Reset** button stops flashing and remains on.
- If you are upgrading from ACS V8.7-*x* to V8.8-*x*, shut down controller A with the following CLI command:

```
HSGB> SHUTDOWN OTHER_CONTROLLER
```

18. Run *VTDPY* to verify that all units are online and that expected I/O activity is resumed by entering the following command:

```
HSGB> RUN VTDPY
```

19. Wait a minimum of 60 seconds to allow the unit to fail over and the resumption of expected I/O as seen for used units under the KB/S column of the display. The unit online status is indicated by an O under the ASWC column of the display.

20. Exit *VTDPY* by pressing **Ctrl+C**, and then enter the following command:

```
VTDPY> EXIT
```

21. Upgrade the software on controller A by performing the following substeps:

- a. Remove the program card ESD cover from controller A.
- b. Press and hold the controller **Reset** button while ejecting the old program card.
- c. After ejecting the program card, release the **Reset** button.
- d. Press and hold the **Reset** button while inserting the new program card.
- e. After the card is fully inserted, release the button.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button. Disregard messages pertaining to misconfigured controllers or failover status.

f. Install the program card ESD cover on controller A.

22. Connect a PC or terminal to the maintenance port on controller A.



Caution: Stop at this point when upgrading the initiator site controllers and proceed to upgrade the target site controllers.

Failure to stop at this point, without fully upgrading the target site controllers, can cause the initiator and target site controllers to become dysfunctional and prevent the host from accessing data storage in these subsystems.

Part 3: Target site upgrade

Continue the rolling upgrade by entering the following procedure on the target site controllers:



Caution: Before attempting the upgrade, verify that the subsystem is in a stable state. This can be verified by examining the controller **Reset** button and the adjacent LEDs. The **Reset** button should be flashing, while all LEDs should be off (no light). Failure to perform this verification can result in the loss of data or leave the controller in an unusable state.

Note: If you have several servers with multiple LUNs in your storage area network (SAN) and are using HP StorageWorks Secure Path Manager, HP recommends that you verify that all units are online by using the `SHOW UNITS FULL` CLI command. Afterwards, move all LUNs to the controller to be updated last by using HP StorageWorks Secure Path Manager. (LUNs may be moved by either controller.)

Note: During the target site upgrade, one of the initiator site controllers can restart with an instance code of `0xE096980`. This potential restart is expected and the associated instance code can be disregarded.

1. Connect a PC or terminal to the maintenance port of controller A, at the target site.
2. Determine if the controller is in SCSI-2 mode and the CCL is enabled by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```

Figure 84 shows only a portion of the resulting display—arrows point to the pertinent status indication.

```

Controller:
      HSG80                      (C) DEC ZG80200258 Software V88P,
                                Hardware E01
      NODE_ID                    = 5000-1FE1-0007-B780
      ALLOCATION_CLASS            = 1
      → SCSI_VERSION            = SCSI-2
      Configured for MULTIBUS_FAILOVER with ZG92810098
                                In dual-redundant configuration
      Device Port SCSI address 7
      Time: 14-Mar-2005         15:44:25
      → Command Console LUN is lun 0 (IDENTIFIER = 0)

```

Figure 84: Screen display indicating SCSI version and CCL setting

3. Delete any Snapshot units by entering the following commands:
 - a. Identify all Snapshot units by entering the following command:


```
HSGA> SHOW UNITS FULL
```
 - b. Record the configuration for each Snapshot unit for later restoration.
 - c. Individually delete all Snapshot units by entering the following command:


```
HSGA> DELETE snapshot-unit-name
```
 - d. Verify that all Snapshot units were deleted by entering the following command:


```
HSGA> SHOW UNITS FULL
```

Note: If any Snapshot unit exists, repeat [step 3](#).

4. Identify and record the current cache flush timer value of the “this controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:


```
HSGA> SHOW THIS_CONTROLLER
```

Figure 85 shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
    256 megabyte write cache, version 0022
    Cache is GOOD
    No unflushed data in cache
    → CACHE_FLUSH_TIMER=DEFAULT (10 seconds)
```

Figure 85: Screen display indicating cache flush timer value

5. Identify and record the current cache flush timer value of the “other controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:

```
HSGA> SHOW OTHER_CONTROLLER
```

Note: The cache flush timer value is displayed in the caching parameters section. This parameter is modified during the procedure and must be restored later in this procedure.

6. For each unit, identify and record the unit writeback cache characteristic by entering the following command:

```
HSGA> SHOW UNITS FULL
```

Note: The writeback cache characteristic is modified during the upgrade and must be restored in [step 26](#) on page 201.

7. Set the cache flush timer to 1 second by entering the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=1
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=1
```

8. Disable writeback caching on all units to help minimize the failover time by entering the following command as required for each unit:

```
HSGA> SET unit-name NOWRITEBACK_CACHE
```

- Determine if all data is flushed from the cache module by entering the following commands:

```
HSGA> SHOW THIS_CONTROLLER  
HSGA> SHOW OTHER_CONTROLLER
```

Figure 86 shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:  
  
    256 megabyte write cache, version 0022  
    Cache is GOOD  
→   No unflushed data in cache  
    CACHE_FLUSH_TIMER=1 SECOND
```

Figure 86: Screen display indicating whether flushed data remains in cache

- Repeat [step 9](#) on both controllers until no unwritten data remains in either cache module memory.
- If unwritten data is present after several minutes, verify that writeback cache was disabled on all units by entering the `SHOW UNITS FULL` command. For any units with writeback cache enabled, return to [step 6](#) on page 197 and proceed.
- Shut down controller B by entering the following command:

```
HSGA> SHUTDOWN OTHER_CONTROLLER
```

Note: Disregard any messages pertaining to misconfigured controllers or failover status.

Note: After controller B shuts down, the **Reset** button and the first three LEDs turn on (see [Figure 82](#) on page 192). Proceed only after the **Reset** button stops flashing and remains on.

- Verify that all units failed over to controller A by entering the following command to show the status of each unit:

```
HSGA> SHOW UNITS FULL
```

Figure 87 shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
State:
  → ONLINE to this controller
    Not reserved
```

Figure 87: Screen display indicating online status of the unit

14. Run *VTDPY* to verify that all units are online and that expected I/O activity is resumed by entering the following command:

```
HSGA> RUN VTDPY
```

15. Wait a minimum of 60 seconds to allow the unit to fail over and the resumption of expected I/O as seen for used units under the KB/S column of the display. The unit online status is indicated by an O under the ASWC column of the display.

16. Exit *VTDPY* by pressing **Ctrl+C**, and then enter the following command:

```
VTDPY> EXIT
```

Note: In [step 17](#) and [step 18](#) (on page 200), controller B is updated first. After controller B restarts, it automatically shuts down controller A if you are upgrading from ACS V8.6-*x* to V8.8-*x*. If you are upgrading from ACS V8.7-*x* to V8.8-*x*, manually shut down controller A by entering the `SHUTDOWN OTHER_CONTROLLER` command.

17. Upgrade the software on controller B by performing the following substeps:

Note: After [step 17](#) is performed, the previous ACS version cannot be restored to this subsystem.

- a. Remove the program card ESD cover from controller B.
- b. Press and hold the controller **Reset** button while ejecting the old program card.
- c. After ejecting the program card, release the **Reset** button.
- d. Press and hold the **Reset** button while inserting the new program card.

- e. After the card is fully inserted, release the **Reset** button.

Controller B restarts.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button. Disregard messages pertaining to misconfigured controllers or failover status.

- f. Install the program card ESD cover on controller B.

Controller A shuts down.

18. After controller B restarts, verify that controller B completed initialization by performing the following substeps:

- a. Connect a PC or terminal to maintenance port of controller B.
- b. Verify that the CLI prompt for controller B is displayed.

Note: Wait for the CLI prompt before proceeding.

- c. Perform one of the following options:

- If you are upgrading from ACS V8.6-*x* to V8.8-*x*, verify controller A is shut down and that the **Reset** button and the first three LEDs turn on (See [Figure 82](#) on page 192). Proceed only after the **Reset** button stops flashing and remains on.
- If you are upgrading from ACS V8.7-*x* to V8.8-*x*, shut down controller A with the following CLI command:

```
HSGB> SHUTDOWN OTHER_CONTROLLER
```

19. Run *VTDPY* to verify that all units are online and that expected I/O activity is resumed by entering the following command:

```
HSGB> RUN VTDPY
```

20. Wait a minimum of 60 seconds to allow the unit to fail over and the resumption of expected I/O as seen for used units under the KB / S column of the display. The unit online status is indicated by an O under the ASWC column of the display.

21. Exit *VTDPY* by pressing **Ctrl+C**, and then enter the following command:

```
VTDPY> EXIT
```

22. Upgrade the software on controller A by performing the following substeps:
 - a. Remove the program card ESD cover from controller A.
 - b. Press and hold the controller **Reset** button while ejecting the old program card.
 - c. After ejecting the program card, release the **Reset** button.
 - d. Press and hold the **Reset** button while inserting the new program card.
 - e. After the card is fully inserted, release the button.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button. Disregard messages pertaining to misconfigured controllers or failover status.

- f. Install the program card ESD cover on controller A.
23. Connect a PC or terminal to the maintenance port of controller A.
24. After controller A restarts, restore the cache flush timer to the values recorded in [step 4](#) and [step 5](#) (starting on page 196) by entering the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=n
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=n
```

25. Verify that the CACHE_FLUSH_TIMER values have been updated:

```
HSGA> SHOW THIS_CONTROLLER
HSGA> SHOW OTHER_CONTROLLER
```

26. For each unit, restore the WRITEBACK_CACHE settings as recorded in [step 6](#) on page 197 by entering the following command:

```
HSGA> SET unit-name WRITEBACK_CACHE
```

27. After updating the cache setting for each unit, verify the change:

```
HSGA> SHOW unit-name
```

28. Restore all Snapshot units removed in [step 3](#) on page 196.
29. If the CCL was disabled in [step 2](#) on page 195, enable it by entering the following command:

```
HSGA> SET THIS_CONTROLLER COMMAND_CONSOLE_LUN
```

30. After enabling the CCL, verify the change:

```
HSGA> SHOW THIS_CONTROLLER
```

31. Disconnect the PC or terminal from the maintenance port of controller A.
Upgrade on the target site controllers is complete.

Part 4: Initiator site upgrade (final steps)

Continue the interrupted upgrade of the initiator site controllers (see [step 16](#) on page 193) as follows:

1. After controller A restarts, restore the cache flush timer values to the values recorded in [step 4](#) and [step 5](#) (starting on page 190) by issuing the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=n
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=n
```

2. Verify that the CACHE_FLUSH_TIMER values have been updated:

```
HSGA> SHOW THIS_CONTROLLER
HSGA> SHOW OTHER_CONTROLLER
```

3. For each unit, restore the writeback cache setting as recorded in [step 6](#) on page 190 by entering the following command:

```
HSGA> SET unit-name WRITEBACK_CACHE
```

4. After updating the cache setting for each unit, verify the change:

```
HSGA> SHOW unit-name
```

5. Restore all Snapshot units removed in [step 3](#) on page 189.
6. If the CCL was disabled in [step 2](#) on page 189, re-enable it by entering the following command:

```
HSGA> SET THIS_CONTROLLER COMMAND_CONSOLE_LUN
```

7. After enabling the CCL, verify the change:

```
HSGA> SHOW THIS_CONTROLLER
```

8. Disconnect the PC or terminal from the maintenance port of controller A.

The upgrade of the initiator site controllers is complete. Refer to the “[After-upgrade maintenance checks](#)” section that starts on page 213 for additional after-upgrade steps if you are upgrading from ACS V8.7-2 or later.

Shutdown upgrade procedures for DRM configurations

Specific controllers are referred to as controller A or controller B during the procedure. For clarity, the CLI prompts illustrated in this procedure use *HSGA>* and *HSGB>* to indicate which controller (A or B) is used.

Note: The following steps *must* be followed carefully for the upgrade to work properly. This procedure takes approximately 5 to 10 minutes. The units involved are unavailable during the upgrade procedure.



Caution: Before upgrading, verify that the subsystem is in a stable state. This can be verified by examining the controller **Reset** button and the adjacent LEDs. The **Reset** buttons should be flashing. All adjacent LEDs should be off (no light). Also, verify that the controller is not reporting a lot of event information. Issue a `SHOW THIS CONTROLLER` CLI command from each involved controllers to ensure controllers are responding to CLI commands as well. Failure to perform this verification can result in data loss or leave the controller in an unusable state.

Note: HP recommends that no remote copy set normalize, merge, or copy operations be active at the time the upgrade begins.

The shutdown upgrade consists of three parts:

- [Part 1: Initiator site controller \(initial steps\)](#), page 203
- [Part 2: Target site upgrade](#), page 207
- [Part 3: Initiator site upgrade \(final steps\)](#), page 211

Part 1: Initiator site controller (initial steps)

Begin the shutdown upgrade by entering the following procedure on the initiator site controllers:

1. From a host console, stop all host activity to the controllers, and then dismount the logical units in the subsystem.
2. Connect a PC or terminal to the maintenance port of controller A, at the initiator site.

3. Determine if the controller is in SCSI-2 mode and the CCL is enabled by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```

Figure 88 shows only a portion of the resulting display—arrows point to the pertinent status indication.

Controller:

```
HSG80                (C) DEC ZG80200258 Software V88P,
                      Hardware E01
```

```
NODE_ID              = 5000-1FE1-0007-B780
```

```
ALLOCATION_CLASS      = 1
```



```
SCSI_VERSION         = SCSI-2
```

```
Configured for MULTIBUS_FAILOVER with ZG92810098
```

```
          In dual-redundant configuration
```

```
Device Port SCSI address 7
```

```
Time: 14-Mar-2005    15:44:25
```



```
Command Console LUN is lun 0 (IDENTIFIER = 0)
```

Figure 88: Screen display indicating SCSI and CCL settings

4. If the controller is running in SCSI-2 mode and the CCL is enabled, you must disable the CCL prior to upgrading by performing the following substeps:
 - a. If the controller is in SCSI-2 mode and the CCL is enabled, record the status for restoration in [step 4](#) on page 211.
 - b. Disable the CCL by entering the following command:
5. Delete all Snapshot units by performing the following substeps:
 - a. Identify all Snapshot units by entering the following command:
 - b. Record the configuration for each Snapshot unit for later restoration.
 - c. Individually delete all Snapshot units by entering the following command:

```
HSGA> SET THIS_CONTROLLER NOCOMMAND_CONSOLE_LUN
```

```
HSGA> SHOW UNITS FULL
```

```
HSGA> DELETE snapshot-unit-name
```

- d. Verify that all Snapshot units were deleted by entering the following commands, as required:

```
HSGA> SHOW UNITS FULL
```

Note: If any Snapshot unit exists, repeat [step 5](#) on page 204.

6. Identify and record the current cache flush timer value of the “this controller.” The subsequent screen displays the cache flush timer value:

```
HSGA> SHOW THIS_CONTROLLER
```

[Figure 89](#) shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
      256 megabyte write cache, version 0022
      Cache is GOOD
      No unflushed data in cache
      → CACHE_FLUSH_TIMER=DEFAULT (10 seconds)
```

Figure 89: Screen display indicating cache flush timer value

7. Identify and record the current cache flush timer value of the “other controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:

```
HSGA> SHOW OTHER_CONTROLLER
```

Note: The cache flush timer value is displayed in the caching parameters section. This parameter is modified during the procedure and must be restored later in this procedure.

8. Set the cache flush timer to 1 second to minimize the flush time, by entering the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=1
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=1
```

9. Determine if all data is flushed from the cache module, by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```

Figure 90 shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
      256 megabyte write cache, version 0022
      Cache is GOOD
      → No unflushed data in cache
      CACHE_FLUSH_TIMER=1 SECOND
```

Figure 90: Screen display indicating whether flushed data remains in cache

Note: Repeat [step 6](#) (on page 183) on both controllers (“this controller” and the “other controller”) until no unwritten data remains in either cache module memory.

10. Shut down both controllers by entering the following commands:

```
HSGA> SHUTDOWN OTHER_CONTROLLER
HSGA> SHUTDOWN THIS_CONTROLLER
```

Note: After the controllers shut down, the **Reset** buttons and the first three LEDs turn on. This can take several minutes, depending on the amount of data that needs to be flushed from the cache modules. Proceed only after the **Reset** buttons stop flashing and remain solid.

11. Upgrade the software on both controllers by performing the following substeps:

- a. Remove the program card ESD cover from controller A.
- b. Press and hold the **Reset** button while ejecting the old program card.
- c. After the program card is ejected, release the **Reset** button.
- d. Repeat [substep a](#) through [substep c](#) for controller B.

Note: In [substep e](#) and [substep f](#) (starting on page 207), the simultaneous release of the **Reset** buttons is critical to ensure that both controllers are restarted and upgraded simultaneously.

- e. Simultaneously press and hold the **Reset** button on both controllers, and insert a new program card into each controller.
- f. Simultaneously release the **Reset** buttons. Both controllers restart.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button. Disregard messages pertaining to misconfigured controllers or failover status.

- g. Install a program card ESD cover on each controller.



Caution: Stop at this point after upgrading the initiator site controllers and proceed to upgrade the target site controllers. Failure to stop at this point, without fully upgrading the target site controllers, can cause the initiator and target site controllers to become dysfunctional and prevent the host from accessing data storage in these subsystems.

Part 2: Target site upgrade

Continue the shutdown upgrade by completing the following steps on the target site controllers:

Note: During the target site upgrade, one of the initiator site controllers can restart with an instance code of 0xE096980. This potential restart is expected and the associated instance code can be disregarded.

1. From a host console, stop all host activity to the controllers, and then dismount the logical units in the subsystem.
2. Connect a PC or terminal to the maintenance port of controller A, at the target site.
3. Determine if the controller is in SCSI-2 mode and the CCL is enabled by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```

Figure 91 shows only a portion of the resulting display—arrows point to the pertinent status indication.

```

Controller:
HSG80                      (C) DEC ZG80200258 Software V88P,
                           Hardware E01
NODE_ID                    = 5000-1FE1-0007-B780
ALLOCATION_CLASS            = 1
→ SCSI_VERSION             = SCSI-2
Configured for MULTIBUS_FAILOVER with ZG92810098
                           In dual-redundant configuration
Device Port SCSI address 7
Time: 14-Mar-2005         15:44:25
→ Command Console LUN is lun 0 (IDENTIFIER = 0)

```

Figure 91: Screen display indicating SCSI version and CCL setting

4. Delete all Snapshot units by performing the following substeps:
 - a. Identify all Snapshot units by entering the following command:


```
HSGA> SHOW UNITS FULL
```
 - b. Record the configuration for each Snapshot unit for restoration in [step 14](#) on page 211.
 - c. Individually delete all Snapshot units by entering the following command:


```
HSGA> DELETE snapshot-unit-name
```
 - d. Verify that all Snapshot units were deleted by entering the following commands, as required:


```
HSGA> SHOW UNITS FULL
```

Note: If any Snapshot unit exists, repeat [step 4](#).

5. Identify and record the current cache flush timer value of the “this controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:

```
HSGA> SHOW THIS_CONTROLLER
```

Figure 92 shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
    256 megabyte write cache, version 0022
    Cache is GOOD
    No unflushed data in cache
    → CACHE_FLUSH_TIMER=DEFAULT (10 seconds)
```

Figure 92: Screen display indicating cache flush timer value

6. Identify and record the current cache flush timer value of the “other controller.” After issuing the following command, the subsequent screen displays the cache flush timer value:

```
HSGA> SHOW OTHER_CONTROLLER
```

Note: The cache flush timer value is displayed in the caching parameters section. This parameter is modified during the procedure and must be restored later in this procedure.

7. Set the cache flush timer to 1 second by entering the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=1
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=1
```

8. Determine if all data is flushed from the cache module, by entering the following command:

```
HSGA> SHOW THIS_CONTROLLER
```

Figure 93 shows only a portion of the resulting display—an arrow points to the pertinent status indication.

```
Cache:
    256 megabyte write cache, version 0022
    Cache is GOOD
    → No unflushed data in cache
    CACHE_FLUSH_TIMER=1 SECOND
```

Figure 93: Screen display indicating whether flushed data remains in cache

9. Repeat [step 8](#) (on page 209) on both controllers (“this controller” and the “other controller”) until no unwritten data remains in either cache module memory.
10. Shut down both controllers by entering the following commands:

```
HSGA> SHUTDOWN OTHER_CONTROLLER  
HSGA> SHUTDOWN THIS_CONTROLLER
```

Note: After the controllers shut down, the **Reset** buttons and the first three LEDs turn on. This can take several minutes, depending on the amount of data that needs to be flushed from the cache modules. Proceed only after the **Reset** buttons stop flashing and remain solid.

11. Upgrade the software on both controllers by performing the following substeps:
 - a. Remove the program card ESD cover from controller A.
 - b. Press and hold the **Reset** button while ejecting the old program card.
 - c. After the program card is ejected, release the **Reset** button.
 - d. Repeat [substep a](#) through [substep c](#) for controller B.

Note: In [substep e](#) and [substep f](#), the simultaneous release of the **Reset** buttons is critical to ensure that both controllers are restarted and upgraded simultaneously.

- e. Simultaneously press and hold the **Reset** button on both controllers, and insert a new program card into each controller.
 - f. Simultaneously release the **Reset** buttons.
Both controllers restart.

Note: A controller restart can take as long as 60 seconds, indicated by the temporary cycling of the port LEDs and a flashing **Reset** button. Disregard messages pertaining to misconfigured controllers or failover status.

- g. Install a program card ESD cover on each controller.

12. After the controllers restart, restore the CACHE_FLUSH_TIMER to the values recorded in [step 5](#) and [step 6](#), which starts on page 208, by entering the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=n
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=n
```

13. Verify that the CACHE_FLUSH_TIMER values have been updated:

```
HSGA> SHOW THIS_CONTROLLER
HSGA> SHOW OTHER_CONTROLLER
```

14. Restore all Snapshot units removed in [step 4](#) on page 208.
15. If the CCL was disabled in [step 3](#) on page 207 enable it by entering the following command:

```
HSGA> SET THIS_CONTROLLER COMMAND_CONSOLE_LUN
```

16. After enabling the CCL, verify the change:

```
HSGA> SHOW THIS_CONTROLLER
```

17. Mount the logical units on the host.
 18. Disconnect the PC or terminal from the maintenance port of controller A.
- Upgrade on the target site controllers is complete.

Part 3: Initiator site upgrade (final steps)

Continue the interrupted upgrade of the initiator site controllers (see [step 11](#) on page 206) as follows:

1. After controller A restarts, restore the cache flush timer values to the values recorded in [step 6](#) and [step 7](#), which starts on page 205, by issuing the following commands:

```
HSGA> SET THIS_CONTROLLER CACHE_FLUSH_TIMER=n
HSGA> SET OTHER_CONTROLLER CACHE_FLUSH_TIMER=n
```

2. Verify that the CACHE_FLUSH_TIMER values have been updated:

```
HSGA> SHOW THIS_CONTROLLER
HSGA> SHOW OTHER_CONTROLLER
```

3. Restore all Snapshot units removed in [step 5](#) on page 204.
4. If the CCL was disabled in [step 4](#) on page 204, re-enable it by entering the following command:

```
HSGA> SET THIS_CONTROLLER COMMAND_CONSOLE_LUN
```

5. After enabling the CCL, verify the change:

```
HSGA> SHOW THIS_CONTROLLER
```

6. Mount the logical units on the host.
7. Disconnect the PC or terminal from the maintenance port of controller A.

The upgrade of the initiator site controllers is complete. Refer to the “[After-upgrade maintenance checks](#)” section that starts on page 213 for additional after-upgrade steps if you are upgrading from ACS V8.7-2 or later.

After-upgrade maintenance checks

ACS V8.7-2 potentially allows for silent metadata inconsistencies to develop if a disk drive was spared into a RAIDset (either manually or automatically). With ACS V8.8-1, at the time the controller is first upgraded, the firmware provides metadata inconsistency corrections within the controller memory. However, corrected information is not written to the disk devices during the upgrade process. Although the controller continues to function normally, unit failovers work correctly, and there is no impact to you, HP recommends that you take the steps necessary to correct the inconsistency that exists on the metadata portion of the container.

This section provides specific subsystem checks that you must complete after you upgrade to ACS V8.8-1. Specific after-upgrade topics include:

- [Handling RAIDset containers with at least one unit above the container \(recommended offline method\)](#)
- [Handling RAIDset containers without a unit above the container](#)
- [Manually manipulating disk devices needing repair \(alternative procedure\)](#)
- [Handling concatenated storagesets with RAIDset containers needing repair](#)
- [Handling target site remote copy sets made of RAIDsets that need repair](#)
- [Handling initiator site remote copy sets made of RAIDsets that need repair](#)
- [Handling failures during the add of a unit above a RAIDset container](#)

Note: Perform the following check only if the ACS version before upgrading the subsystem to ACS V8.8-1 was ACS V8.7-2 or a later patch. Do not perform the following checks if you were running only ACS V8.6-x, V8.7-0 or V8.7-1 previous to upgrading to ACS V8.8-1.

Note: If you decide to physically remove the members of a RAIDset and place them into another subsystem running ACS V8.7-x or V8.6, and that RAIDset currently shows a status of Maintenance Recommended, it is essential that you perform the `REINITIALIZE container-name` CLI command before removing devices in the container from the ACS V8.8-1 subsystem.

After completing the ACS upgrade, execute the following command on each controller if you upgraded from ACS V8.7-2 or later:

```
SHOW RAIDSETS SPECIAL_FUNCTION_ONE
```

An example of the subsequent screen (for the top controller) is displayed in [Figure 94](#). As you review [Figure 94](#), note that units D11, D12, and D13 of RAIDset R1 are partitioned RAIDsets. Also, RAIDset R6 has no units above it.

Name	Status	Used by
R1	REPORTED ON OTHER CONTROLLER	D11
		D12
		D13
R2	GOOD	D2
R3	REPORTED ON OTHER CONTROLLER	D3
R4	MAINTENANCE RECOMMENDED	D4
R5	REPORTED ON OTHER CONTROLLER	
R6	GOOD	
R21	REPORTED ON OTHER CONTROLLER	D21
R31	REPORTED ON OTHER CONTROLLER	D31
T'TOP>		

Figure 94: Example of the screen displayed after issuing the SHOW RAIDSETS SPECIAL_FUNCTION_ONE command (top controller)

An example of the subsequent screen (for the bottom controller) is displayed in [Figure 95](#). As you review [Figure 95](#), note that units D11, D12, and D13 of RAIDset R1 are partitioned RAIDsets. Also, RAIDset R5 has no units configured above it.

Name	Status	Used by
R1	GOOD	D11
		D12
		D13
R2	REPORTED ON OTHER CONTROLLER	D2
R3	GOOD	D3
R4	REPORTED ON OTHER CONTROLLER	D4
R5	MAINTENANCE RECOMMENDED	
R6	REPORTED ON OTHER CONTROLLER	
R21	GOOD	D21
R31	GOOD	D31

Figure 95: Example of the screen displayed after issuing the SHOW RAIDSETS SPECIAL_FUNCTION_ONE command (bottom controller)

The status of a RAIDset storage container is only valid on the controller owning the RAID container. While taking action, work from the controller on which the RAID container is owned.

Note: After invoking the `REINITIALIZE container-name SPECIAL_FUNCTION_ONE=PARTITION` or `REINITIALIZE container-name SPECIAL_FUNCTION_ONE=NOPARTITION` command in a dual-redundant controller configuration, ownership of the RAID container is automatically transferred to the controller on which the command was *not* executed.

Repairing disk devices (offline and alternative methods)

This section covers the following topics:

- [Handling RAIDset containers with at least one unit above the container \(recommended offline method\)](#), page 216
- [Manually manipulating disk devices needing repair \(alternative procedure\)](#), page 216

Handling RAIDset containers with at least one unit above the container (recommended offline method)

Note: Although the above procedures are recommended for repairing RAIDsets, you can also use the procedures described in [“Manually manipulating disk devices needing repair \(alternative procedure\).”](#)

If any RAIDset shows a status of `Maintenance Recommended`, and the RAIDset is currently associated with a unit (including a unit above a partition), the ACS V8.8-1 upgrade process provides an in-controller memory correction for any deficiency attributed to the metadata for the RAIDset. Although you can use this unit indefinitely with the metadata corrections applied only to the in-controller memory, HP recommends that during the maintenance window you take the units off the container, invoke the following CLI command with the `PARTITION` or `NONPARTITION` qualifier on the container, as appropriate:

```
REINITIALIZE container-name SPECIAL_FUNCTION_ONE=
```

After you issue the above command, add the unit back onto the container. This maintenance command (if a unit is not present on the container) forces an update of the metadata onto the disks of the container.

Note: If you decide to physically remove the members of a RAIDset and place them into another subsystem running ACS V8.7-*x* or V8.6, and that RAIDset currently shows a status of `Maintenance Recommended`, it is essential that you perform the `REINITIALIZE container-name` CLI command before removing devices in the container from the ACS V8.8-1 subsystem.

Manually manipulating disk devices needing repair (alternative procedure)

To manually manipulate and repair disk devices where their status indicates, `MAINTENANCE RECOMMENDED`:

Note: If only one or two RAIDsets are impacted and only a single device within each RAIDset needs maintenance, you can use this alternative procedure.

- 1. Identify the RAIDset unit needing maintenance by issuing the following CLI command:

```
HSG> SHOW RAIDSET SPECIAL_FUNCTION_ONE
```

Figure 96 and Figure 97 (on page 218) show an example of an affected RAIDset.

HSG_TOP> SHOW RAIDSET SPECIAL_FUNCTION_ONE		
Name	Status	Used by

R1	MAINTENANCE RECOMMENDED	D7
R4	GOOD	D10
R5	REPORTED ON OTHER CONTROLLER	D8
RAID1	REPORTED ON OTHER CONTROLLER	CO_RAID
RAID2	REPORTED ON OTHER CONTROLLER	CO_RAID

Figure 96: Example of a RAIDset needing repair on the top controller (following rolling upgrade v87P-6 to V88-1P)

```
HSG_TOP> SHOW R1

Name           Storageset           Uses           Used by
R1             raidset                     DISK10200      D7
                                           DISK20200
                                           DISK30200

Switches:
    POLICY (for replacement) = BEST_PERFORMANCE
    RECONSTRUCT (priority) = NORMAL
    CHUNKSIZE = 256 blocks

State:
    NORMAL
DISK20200 (member 0) is NORMAL
    DISK10200 (member 1) is NORMAL
    DISK30200 (member 2) is NORMAL
Size:                16751956 blocks
```

Figure 97: Example showing the unit affected

2. From the controller on which the unit is online, issue the following command:

```
HSG> REINITIALIZE raidset SPECIAL_FUNCTION_ONE=INFO
```

See [Figure 98](#) for an example. Note that in [Figure 98](#) Unit D7 indicates Un-unpartitioned, and device DISK20200 indicates Marked partitioned: Yes. This combination of partition information indicates that a discrepancy exists on the unit.

```
HSG_TOP> REINITIALIZE R1 SPECIAL_FUNCTION_ONE=INFO
```

```
Unit: D7, Type: Un-partitioned
```

```
Raidset: R1
```

```
Device: DISK10200, Marked partitioned: No, Structure version  
Affected: No, mdata_version (vsi): 11
```

```
Device: DISK30200, Marked partitioned: No, Structure version  
Affected: No, mdata_version (vsi): 11
```

```
Device: DISK20200, Marked partitioned: Yes, Structure version  
Affected: Yes, mdata_version (vsi): 11
```

Figure 98: Example of a device showing inconsistent metadata attributes that differ from the attributes of the container

3. Identify which specific disk device needs repair. Ensure that it is a fully normalized RAIDset.

4. Identify RAIDset replacement policy (see [Figure 99](#)).

```

HSG_TOP> SHOW R1
Name                Storageset                Uses                Used by
-----
R1                  raidset                DISK10200            D7
                   DISK20200
                   DISK30200

Switches:
  POLICY (for replacement) = BEST_PERFORMANCE
  RECONSTRUCT (priority) = NORMAL
  CHUNKSIZE = 256 blocks

State:
  NORMAL
  DISK20200 (member 0) is NORMAL
  DISK10200 (member 1) is NORMAL
  DISK30200 (member 2) is NORMAL

Size:                16751956 blocks

```

Figure 99: Example showing the RAIDset policy setting and issued command to change policy setting to NOPOLICY

5. Change RAIDset replacement policy to NOPOLICY to allow the device to be placed back into the RAIDset.

```
HSG_TOP>SET RAIDset-name NOPOLICY
```

Note: Turning off sparing policy allows you to have control of the device that is put back into the RAIDset.

6. Remove device from RAIDset membership by entering the following command:

```

HSG_TOP> SET RAIDset-name REMOVE=disk-name
HSG_TOP> DELETE FAILEDSETS disk-name

```

Figure 99 on page 220 shows an example of how to remove a device from a RAIDset membership. An event (Instance Code 02675201), reported on the CLI, indicates that the device specified in the Device Locator field has been removed from the RAIDset associated with the logical unit.

Note: The drive displayed in Figure 99 on page 220, shows a drive with partition attributes different from the attributes at the RAIDset level. The drive metadata is inconsistent.

7. Add the same device back into the RAIDset as new member by issuing the following command:

```
HSG_TOP> SET RAIDset-name REPLACE=disk-name
```

Adding the device back into the RAIDset as a new member, clears metadata inconsistencies in the device. After adding the device back into the RAIDset as a new member, an event (Instance Code 021E0064), reported on the CLI, indicates that the RAIDset is Reconstructing.

Afterwards, another event (Instance Code 02220064), reported on the CLI, indicates that the RAIDset is finished Reconstructing and is Normalizing. After the RAIDset begins Normalizing, you do not need to wait for that completion unless a second device in the same RAIDset needs repaired.

8. Return the RAIDset replacement policy back to original setting.

Note: While the RAIDset is reconstructing, you will *not* be fully redundant until normalization is *fully* complete. If the subsystem is under heavy I/O, reconstruction can take several hours on a very large device. Reconstructing RAIDsets can be a time-consuming process for two or more devices needing to be fixed because you have to wait for reconstruct to complete before initiating the same operation on another device in the same RAIDset. HP recommends that you free units from use, take the units out of the configuration, and then place the units above the RAIDset.

9. Verify that the procedure was successful by ensuring that the affected RAIDset is GOOD and placed in the appropriate RAIDset (see [Figure 100](#) and [Figure 101](#)).

```

HSG_TOP> SHOW R1
Name           Storageset           Uses           Used by
-----
R1             raidset                DISK10200       D7
                DISK20200
                DISK30200

Switches:
  NOPOLICY (for replacement)
  RECONSTRUCT (priority) = NORMAL
  CHUNKSIZE = 256 blocks

State:
  RECONSTRUCT 2% complete on member DISK20200
  DISK20200 (member 0) is RECONSTRUCTING 2% complete <==
Reconstructing progress
  DISK10200 (member 1) is NORMAL
  DISK30200 (member 2) is NORMAL

```

Figure 100: Example of resulting RAIDset attributes

```

HSG_TOP> SHOW RAIDSET SPECIAL_FUNCTION_ONE
Name           Status           Used by
-----
R1             GOOD             D7
R4             GOOD             D10
R5             REPORTED ON OTHER CONTROLLER D8
RAID1          REPORTED ON OTHER CONTROLLER CO_RAID
RAID2          REPORTED ON OTHER CONTROLLER CO_RAID

```

Figure 101: Example of the original RAIDset with a Good status

Handling RAIDset containers without a unit above the container

For RAIDsets without a unit above the container, HP recommends that you take immediate steps to either initialize RAIDsets if data on the media is not needed, or invoke the following CLI command with the *PARTITION* or *NOPARTITION* qualifier, as appropriate:

```
REINITIALIZE container-name SPECIAL_FUNCTION_ONE=
```

After issuing the above command, allow the controller to update the media on the disk with corrected metadata elements from controller memory.

Handling failures during the add of a unit above a RAIDset container

After upgrading to V8.8-1, if you attempt to place a unit above the RAIDset storage container, you might receive the following message:

```
Error 1171: Inconsistent partitioning on container, see  
REINITIALIZE command.
```

If you receive Error 1171, this indicates that the controller could not accurately determine whether the container is partitioned or non-partitioned, and, consequently, disallows you from taking action until you invoke the following CLI command with the *PARTITION* or *NOPARTITION* qualifier:

```
REINITIALIZE container-name SPECIAL_FUNCTION_ONE=
```

You must identify whether or not the container is partitioned. After you issue the above command and identify to the controller the container type (partitioned or non-partitioned), the controller proceeds to set the metadata to indicate it is a partitioned or non-partitioned container. Afterwards, you may proceed to add non-partitioned units or partitioned units above the container.

Handling target site remote copy sets made of RAIDsets that need repair

To repair RAIDsets that are part of remote copy set (RCS) units, it is necessary to complete the following steps on the target site:

1. Delete the unit (for example, `DEL D1`).
2. Complete the repair (for example, `REINITIALIZE container-name SPECIAL_FUNCTION_ONE=NOPARTITION`).
3. Place the RCS unit back into place.
4. Complete a full RCS copy.

Note: Although the above procedures are recommended for repairing RAIDsets, you can also use the procedures described in [“Repairing disk devices \(offline and alternative methods\)”](#) on page 215.

Handling initiator site remote copy sets made of RAIDsets that need repair

After you complete the repair steps outlined in the [“Handling target site remote copy sets made of RAIDsets that need repair,”](#) complete the following steps on the initiator site:

1. Stop all I/O to units associated with the RCS.
2. Remove the target unit from the initiator RCS (for example, `SET remote-copy-set-name REMOVE=remote-node-name/target-unit name`).

Note: If an RCS is part of an association set with a write history log unit, remove the write history log unit. For example, issue the `SET association-set-name NOLOG` CLI command, and then issue the `DELETE association-set-name` command.

3. Delete the unit (for example, `DELETE unit-number`).
4. Reinitialize the container (for example, `REINITIALIZE container-name SPECIAL FUNCTION ONE=NO PARTITION`).
5. Recreate the unit.
6. Add connection to the unit (for example, `SET unit-number ENABLE_ACCESS_PATH=connection-names`, and then issue the `ADD REMOTE_COPY_SETS remote-copy-set-name remote-node-name\target-unit-name` command).

Note: Although the above procedures are recommended for repairing RAIDsets, you can also use the procedures described in [“Repairing disk devices \(offline and alternative methods\)”](#) on page 215.

Handling concatenated storagesets with RAIDset containers needing repair

[Figure 102](#) on page 225 shows an example of the steps that must be taken in order to clean up a RAIDset member of a concatenated storageset. This example shows units D1, C1, R1, and R2 (the added member) with the affected RAIDset containers. During this check, verify that no reconstructs are in progress.

```
HSG80T> DEL D1
HSG80T> DEL C1
HSG80T> REINITIALIZE R1 SPECIAL_FUNCTION_ONE=NOPARTITION
HSG80T> REINITIALIZE R2 SPECIAL_FUNCTION_ONE=NOPARTITION
HSG80T> ADD UNIT D1 R1 DISABLE=ALL
HSG80T> ADD CONCAT C1 R1
HSG80T> SET C1 ADD=R2
HSG80T> SET UNIT D1 ENABLE
```

Figure 102: Example of cleanup operations for RAIDset members of a concatenated storageset

Note: Although the above procedures are recommended for repairing RAIDsets, you can also use the procedures described in [“Repairing disk devices \(offline and alternative methods\)”](#) on page 215.

Downgrading ACS V8.8-x to V8.6-1 or V8.7-1

This document describes the procedures necessary to downgrade the controller from the ACS V8.8-x to V8.6-1 or V8.7-1. Downgrading controllers to the previous version should only be completed by HP authorized service personnel. Failure to properly follow the downgrade procedures may result in the loss of data.

Prior to downgrading, ensure that the following items have been completed:

- Dismount all units from the host operating system.
- Terminate any I/O activity to the controller pair that is to be downgraded.
- Normalize all RAIDsets, mirrorsets, and remote copysets.
- Delete any existing snapshot units.

The following controller information is lost during the downgrade procedure:

- Host information that is stored in the expanded area of the host definition tables.
- The HBA reservation style information is converted to the standard reservation style.



Caution: Stagesets or disk devices created or initialized while running V8.8-x can become inaccessible after the downgrade to V8.6-1 or V8.7-1. If you initialize a container and used the *SAVE CONFIGURATION* switch and you then downgrade to ACS V8.7-1 or V8.6-1, the associated units have *MEDIA FORMAT ERROR* as the state of the unit. These units must be deleted and added again while running the downgraded. If data exists on units with a media format error, you must back up existing data to avoid losing data.

Consider the following items before you downgrade ACS:

- Both controllers need to be downgraded prior to starting V8.6-1 or V8.7-1. In other words, both controllers are be stopped (halted) by the downgrade utility with a 39 LED code on the port buttons before restarting them with V8.8-x.
- After downgrading ACS to V8.6-1 or V8.7-1, note that the ECB end-of-life duration is reduced by 1 ½ years and the ECB end-of-life extended flag is cleared.

- The *SCSI_FAIRNESS*, *SMART_ERROR_EJECT* and *DEFAULT_ACCESS_MASK* are cleared in both the downgrade cases.
- If you are downgrading ACS V8.8-*x*, and pre-existing patches from V8.6 or V8.7 remain in controller memory, the system downgrades your system to the highest patch level that was previously installed.

Running the downgrade program

Perform the following procedure to downgrade ACS V8.8-*x* to V8.7-1 or V8.6-1:

1. Begin the downgrade by entering the following command from a CLI prompt:

```
TOP> RUN DWNGRD
```

[Figure 103](#) shows the **Downgrade Program Invoked** screen.

Downgrade Program Invoked.

This program downgrades ACS version 8.8 to either ACS version 8.7-1 or ACS version 8.6-1.

CAUTION: Dismount all units before initiating this procedure.

CAUTION: If you are operating subsystem controllers in a dual-redundant configuration, you must downgrade both controllers to the same ACS version BEFORE restarting the controllers.

Are you sure that you want to run this downgrade procedure (Y/[N])? y

Figure 103: Invoking the downgrade program

This is the first point where you can exit the program without making any changes to the controller configuration. The program continues only if you answer **Y**(es) to this prompt. All other responses are assumed to be **N**(o), and the program exits.

2. Enter **Y**(es) to continue with the downgrade. Otherwise, enter **N**(o) to terminate the downgrade. After **Y**(es) is entered, the system requests which downgrade you want to complete.
3. Enter **A** or **B** to downgrade to ACS V8.7-1 or V8.6-1.

```
A - Downgrade ACS version 8.8 to ACS version 8.7-1.
```

```
B - Downgrade ACS version 8.8 to ACS version 8.6-1.
```

```
Which downgrade do you want to run (A or B)?
```

Figure 104: Downgrade selection

A confirmation screen is displayed.

4. Enter (Y)es to the question asking whether you want to complete the downgrade to continue with the downgrade.
5. Insert the PCMCIA card into the top controller.
6. Complete one of the following two options:
 - If in a single-controller configuration, restart the controller.
 - If in a dual-redundant configuration, repeat [step 1](#) (on page 227) through [step 5](#) on the bottom controller, and then restart both controllers simultaneously.
7. Verify that the system downgraded to the selected ACS version by entering the following command:

```
SHOW THIS CONTROLLER
```

```
SHOW OTHER CONTROLLER
```

8. Verify that all units are available by entering the following command:

```
SHOW UNITS FULL
```

The downgrade program tests for snapshot units on the controller. If snapshot units are found, the program displays the following message and exit.

```
The following snapshot units exist on this controller:
```

```
D20
```

```
D40
```

```
The controller cannot downgrade to ACS V8.6 until all snapshot  
units have been deleted.
```

```
Downgrade program exiting.
```

Figure 105: Screen display indicating existing snapshots

If the host configuration expands into the new area for the enlarged host support table, the information on those host systems is lost. The downgrade program displays the information about those hosts and allows the opportunity to exit before continuing.

The following host information will be lost during this downgrade:

Name	Host Id	Adapter Id	Control	Port	Offset	RStyle
-----	-----	-----	-----	----	-----	-----
Alpha1	0123-4567-8901-1234	0123-4567-8901-1234	this	1	0	Std
NtSrv05	9876-5432-0543-1234	9876-5432-0543-1234	this	1	0	Std

You can exit if you need to reconfigure your systems or record this information.

Do you want to continue the downgrade procedure (Y/ [N])?

Figure 106: Screen display showing host information

ACS V8.7 has a switch used to modify the behavior of persistent reservations. Because this switch does not exist in V8.6, it is removed from all connections that have it defined if you downgrade to V8.6-1. A screen is displayed (see [Figure 107](#)) if there are connections using the new persistent reservation style, and you are given the opportunity to exit before continuing. This is the final opportunity to exit the program before the downgrade occurs.

The following connections will have the reservation style changed:

Name	Host Id	Adapter Id	Control	Port	Offset	RStyle
-----	-----	-----	-----	----	-----	-----
Alpha2	1003-4527-8001-1434	1003-4527-8001-1434	this	1	0	HBA
NtSrv	2106-5432-0543-1234	2106-5432-0543-1234	this	1	0	HBA

You can exit if you need to reconfigure your systems or record this information.

Do you want to continue the downgrade procedure (Y/ [N])?

Figure 107: Screen display showing connections and reservation and providing final opportunity to exit the downgrade process

9. Enter **(Y)**es to proceed with the downgrade.

The system indicates that the downgrade is to begin (see [Figure 108](#)).

```
This controller will now be downgraded to run ACS Version 8.6.  
You must also downgrade the other controller. When both  
controllers have been downgraded, install the ACS Version 8.6  
program cards and restart both controllers at the same time.  
Continue (Y/N)?  
Downgrade procedure complete. Halting.  
%FLL--HSG> --22-NOV-2000 10:33:24-- OCP Code: 39  
NVPM configuration inconsistent.
```

Figure 108: Screen display indicating that the downgrade is beginning

Note: Both controllers halt with the 39 fault LED code before restarting with V8.7.

10. Remove the ACS V8.8-x program cards while holding the controller **Reset** buttons. Insert both ACS V8.7 program cards and release the **Reset** buttons at the same time.

Note: Any storage added while running V8.8-x is not accessible after the downgrade to V8.7. The storage must be deleted and re-added. Be sure to use the *NODESTROY* switch after adding the storagesets back to the system.

Installing, deleting, and listing software patches by using CLCP

Use *CLCP* to manage software patches. These small programming changes are placed into the controller non-volatile memory and become active upon restarting the controller.

Consider the following points while installing or deleting patches:

- Patches are associated with specific software versions. *CLCP* verifies the patch against the currently installed version.
- Patches are sequential; patch one must be entered before patch two, and so on.
- Deleting one patch also deletes all higher-numbered patches. For example, deleting patch two automatically deletes patches three, four, and so on.
- Controllers in a dual-redundant configuration must have the same patches. Install patches into each controller separately.

Installing a software patch

Use the following steps to install a software patch:

1. Obtain the patch file from a customer service representative or the Internet at <http://h18006.www1.hp.com/products/storageworks/acs/index.html>.
2. Connect a PC or terminal to the controller maintenance port.
3. From the host console, quiesce all port activity.
4. Start *CLCP* with the following command:

```
RUN CLCP
```

The **Code Load & Patch local program Main Menu** is displayed (see [Figure 109](#)).

```
Select an option from the following list:
Code Load & Patch local program Main Menu
0: Exit
1: Enter Controller Code LOAD utility
2: Enter Controller Code PATCH utility
3: Enter EMU Code LOAD utility
```

```
Enter option number (0..3) [0] ?
```

Figure 109: Code Load & Patch local program Main Menu

5. Enter option **2**.

The **Code Patch Main Menu** is displayed (see [Figure 110](#)).

```
You have selected the Code Patch local program. This program is used to
manage software code patches. Select an option from the following list:
Type ^Y or ^C (then RETURN) at any time to abort Code Patch.

Code Patch Main Menu
    0: Exit
    1: Enter a Patch
    2: Delete Patches
    3: List Patches

Enter option number (0..3) [0] ?
```

Figure 110: Code Patch Main Menu

6. Enter option **1**.

The **Code Patch Option** screen is displayed (see [Figure 111](#)).

```
This is the Enter a Code Patch option. The program prompts you for the
patch information, one line at time. Be careful to enter the information
exactly as it appears on the patch release. Patches may be installed for
any version of software; however, patches entered for software versions
other than XXXXX are not applied until the matching version of software
is installed.
```

```
To enter any patch, you must first install all patches with lower patch
numbers than the patch you are entering, beginning with patch number 1,
for a specific software version. If you incorrectly enter the patch
information, you are given the option to review the patch one line at a
time.
```

```
Type ^Y or ^C (then RETURN) at any time to abort Code Patch.
```

```
Do you wish to continue (y/n) [y] ?
```

Figure 111: Code Patch Option screen

7. Enter **Y(es)**, and then follow the on-screen prompts.
8. After the patch is installed, press the controller **Reset** button to restart the controller.
9. For dual-redundant controller configurations, repeat [step 2](#) (on page 231) through [step 8](#) for the second controller.

Deleting a software patch

All installed ACS V8.7 (or earlier) patches should be removed after an ACS V8.8-*x* installation since they are no longer applicable. Removing older patches frees up patch memory for future ACS patches.

Use the following steps to delete a software patch:

1. From a host console, quiesce all port activity.
2. Connect a PC or terminal to the controller maintenance port.
3. Start *CLCP* with the following command:

```
RUN CLCP
```

The **Code Load & Patch local program Main Menu** is displayed (see [Figure 112](#)).

```
Select an option from the following list:
Code Load & Patch local program Main Menu
0: Exit
1: Enter Controller Code LOAD utility
2: Enter Controller Code PATCH utility
3: Enter EMU Code LOAD utility

Enter option number (0..3) [0] ?
```

Figure 112: Code Load & Patch local program Main Menu

4. Enter option 2.

The **Code Patch Main Menu** is displayed (see [Figure 113](#)).

```
You have selected the Code Patch local program. This program is used to
manage software code patches. Select an option from the following list:
Type ^Y or ^C (then RETURN) at any time to abort Code Patch.

Code Patch Main Menu
0: Exit
1: Enter a Patch
2: Delete Patches
3: List Patches

Enter option number (0..3) [0] ?
```

Figure 113: Code Patch Main Menu

5. Enter option **2**.

The **Delete Patches** option screen is displayed (see [Figure 114](#)).

```
This is the Delete Patches option. The program prompts you for the
software version and patch number you wish to delete. If you select a
patch for deletion that is required for another patch, all dependent
patches are also selected for deletion. The program lists your deletion
selections and asks if you wish to continue.

Type ^Y or ^C (then RETURN) at any time to abort Code Patch.

The following patches are currently stored in the patch area:

    Software Version - Patch number(s)
    xxxx                xxxx

Currently, xx% of the patch area is free.

Software Version of patch to delete?
```

Figure 114: Delete Patches Option screen

6. Enter the software version of the patch to delete, and then press **Enter** or **Return**.

The following display appears:

```
Patch Number to delete?
```

7. Enter the patch number to delete, and then press **Enter** or **Return**.

The **Patch Selection Confirmation** screen is displayed (see [Figure 115](#)).

```
The following patches have been selected for deletion:

    Software Version - Patch #
    xxxx                xxxx

Do you wish to continue (y/n) [n] ?
```

Figure 115: Patch Selection Confirmation screen

8. Enter **Y(es)** to delete the patches.

The **Code Patch Main Menu** is displayed (see [Figure 116](#)).

```
Code Patch Main Menu
  0: Exit
  1: Enter a Patch
  2: Delete Patches
  3: List Patches
Enter option number (0..3) [0] ?
```

Figure 116: Code Patch Main Menu

9. Enter option **0**.
10. Press the controller **Reset** button to restart the controller.
11. For dual-redundant controller configurations, repeat [step 1](#) (on page 233) through [step 10](#) for the second controller.

Listing software patches

Use the following steps to list software patches:

1. Connect a PC or terminal to the controller maintenance port.
2. Start *CLCP* with the following command:

```
RUN CLCP
```

The **Code Load & Patch local program Main Menu** is displayed (see [Figure 117](#)).

```
Select an option from the following list:
Code Load & Patch local program Main Menu
  0: Exit
  1: Enter Controller Code LOAD utility
  2: Enter Controller Code PATCH utility
  3: Enter EMU Code LOAD utility
Enter option number (0..3) [0] ?
```

Figure 117: Code Load & Patch local program Main Menu

3. Enter option **2**.

The **Code Patch Main Menu** is displayed (see [Figure 118](#)).

```
You have selected the Code Patch local program. This program is used to
manage software code patches. Select an option from the following list:
Type ^Y or ^C (then RETURN) at any time to abort Code Patch.

Code Patch Main Menu

    0: Exit
    1: Enter a Patch
    2: Delete Patches
    3: List Patches

Enter option number (0..3) [0] ?
```

Figure 118: Code Patch Main Menu

4. Enter option 3.

A screen showing the patches currently install is displayed (see [Figure 119](#)).

The following patches are currently stored in the patch area:

Software Version	Patch Number	Checksum
-----	-----	-----
V86P	2	79517D9B
V86P	3	CB34D779
V86P	4	32D6D171
V86P	5	41884790
V86P	6	5587F375
V86P	7	D600BC72
V86P	8	096F5BCE
V86P	9	13A2DC24
V86P	10	75D52E8B
V87	2	7E1263F1
V87	3	F5FD5EBF
V87	4	E897C93E
V87	5	E9D39F31
V87	6	BE789D1A
V87	7	9A16FCEB

Currently, 12% of the patch area is free.

Code Patch Main Menu

0: Exit

1: Enter a Patch

2: Delete Patches

3: List Patches

Enter option number (0..3) [0] ?

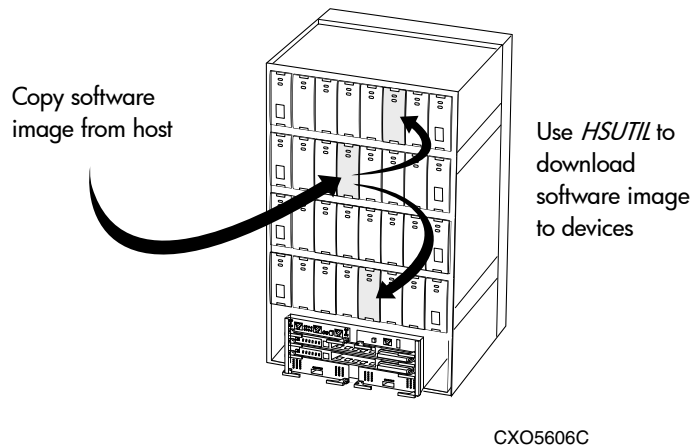
Figure 119: Patch Listing

5. Enter option **0**.
6. For dual-redundant controller configurations, repeat [step 1](#) (on page 235) through [step 5](#) for the second controller.

Upgrading firmware on a device

Use the format and device code load utility (*HSUTIL*) to upgrade a device with firmware located in contiguous blocks at specific logical block numbers (LBNs) on a source disk drive. The source disk drive must be configured as a unit on the same controller. Upgrading firmware on a disk is a two-step process (see [Figure 120](#)):

1. Copy the new firmware from the host to a disk drive configured as a unit in the subsystem.
2. Use *HSUTIL* to load the firmware onto the devices in the subsystem.



CXO5606C

Figure 120: Upgrading device firmware (BA370 enclosure example)

Keep the following points in mind while using *HSUTIL* to upgrade firmware on a device:

- *HSUTIL* is tested with the qualified devices listed in the product-specific release notes that accompanied the software release. Firmware installed on unsupported devices is possible—*HSUTIL* does not prevent this—but if the upgrade fails, the device might be rendered unusable and, therefore, require manufacturer attention.
- If the power fails or the bus is reset while *HSUTIL* is installing the new firmware, the device can become unusable. To minimize this possibility, secure a reliable power source and suspend all I/O to the bus that services the device being upgraded.

- *HSUTIL* cannot install firmware on devices configured as single-disk drive units or as members of a storageset, spareset, or failedset. If installing firmware on a device previously configured as a single-disk drive, delete the unit number and storageset name associated with it.
- During the installation, the source disk drive is not available for other subsystem operations.
- Some devices might not reflect the new firmware version number when viewed from the “other controller” in a dual-redundant controller configuration. If this occurs, enter the following CLI command:
`CLEAR_ERRORS device-name UNKNOWN.`
- Do not issue any CLI commands that access or inspect devices that are being formatted.

Use the following steps to upgrade firmware with *HSUTIL*:

1. Connect a PC or terminal to the controller maintenance port that accesses the device being upgraded.
2. Configure a single-disk unit.

Note: In the next steps, the firmware image is copied to this unit, and *HSUTIL* distributes it to the devices being upgraded. This unit must be a newly initialized disk with no label or file structure to ensure that the firmware image resides in contiguous blocks starting from LBN 0 or another known LBN. Additionally, write-back caching must be disabled.

3. Copy the firmware image to the single-disk unit configured in [step 2](#). The firmware image must begin at a known LBN—usually 0—and must be contiguous.

See the documentation that accompanied the host operating system for instructions on copying firmware images to a disk drive.



Caution: Quiesce the host load before running *HSUTIL*; otherwise, damage to the storage device can occur.

4. Start *HSUTIL* with the following command:

```
RUN HSUTIL
```

The **HSUTIL Main Menu** is displayed (see [Figure 121](#)).

```
HSUTIL Main Menu:
0. Exit
1. Disk Format
2. Disk Device Code Load
3. Tape Device Code Load
4. Disaster Tolerance Backend Controller Code Load
Enter function number: (0:4) [0]?
```

Figure 121: HSUTIL Main Menu

5. Enter option **2**.
6. Choose the single-disk unit as the source disk for the download.
7. Enter the starting LBN of the firmware image—usually LBN 0.
8. Enter the product ID of the device being upgraded. This ID corresponds to the product information reported in the Type column when issuing a `SHOW DISK FULL` command.
HSUTIL lists all devices that correspond to the product ID entered.
9. Enter the disk or tape name of the device being upgraded.
10. Confirm or enter the byte count of the firmware image.
11. Confirm the download.
12. Some disk firmware releases require reformatting the disk after upgrading its firmware. See the documentation that accompanied the firmware to determine if device reformatting is required.
13. After *HSUTIL* finishes downloading the firmware, it displays the new firmware revision for the disk drive.

Upgrading to a dual-redundant controller configuration

Use the following steps to upgrade a single-controller configuration subsystem to a dual-redundant configuration subsystem. To replace failed components, see the “[Replacing BA370, M2100 & M2200 Enclosure Elements](#)” chapter that starts on page 101 for more information. Before beginning this procedure, obtain the following items:

- A second controller with the same software version and patch level as installed in the current single-controller
- A second cache module with the same memory configuration as installed in the current cache module
- A second ECB
- For BA370 enclosures only, a second ECB Y-cable

Use the following steps to install a second controller, cache module and ECB:



Caution: For BA370 enclosures only:

- After installing the controller, check the PVA SCSI ID number on the master enclosure to ensure that it represents the correct enclosure number (ID 0).
 - If the SCSI ID number is not 0, reset it to ID 0 before starting the controller.
-

1. Connect a PC or terminal to the maintenance port of the operational controller.

The controller connected to becomes “this controller,” and the controller being added becomes the “other controller.”

2. Start *FRUTIL* with the following command:

```
RUN FRUTIL
```

3. Enter **N(o)** to question asking you whether you want to replace the battery.
4. Enter option **2**.
5. Enter option **1**.

6. Enter **Y(es)**. A countdown timer allows a total of 4 minutes to install the controller and cache module. After 4 minutes, “this controller” exits *FRUTIL* and resumes operations. If this happens, return to [step 2](#) (on page 242) and proceed.



Caution: ESD can easily damage a cache module or controller. Wear a snug-fitting, grounded ESD wrist strap during this procedure.

7. Insert the new ECB:
 - For BA370 enclosures:
 - a. Insert the ECB into an empty bay or on top of the enclosure.



Caution: The ECB must be disabled—the status light is not lit and is not blinking—before disconnecting the ECB cable from the cache module. Failure to disable the ECB can damage the cache module.

- b. Disable the ECB by pressing the battery disable switch until the status light stops blinking—approximately 5 seconds.
 - c. Connect the new ECB cable to the new cache module.
 - For Model 2200 enclosures, insert the ECB into ECB bay B1.



Caution: Carefully align the cache module in the appropriate guide rails. Misalignment can damage the backplane.

8. Insert the new cache module into its bay and engage its retaining levers.

9. Make sure that the program card is in the new controller, and then insert the controller into its bay. Engage its retaining levers.

After fully seated, the newly installed controller automatically restarts. Press **Enter** or **Return** to continue.

If the “other controller” did not restart, follow these steps:

- a. Press and hold the “other controller” **Reset** button.
- b. Reseat the “other controller” program card.
- c. Release the **Reset** button.

10. Connect all host bus cables to the new controller.

Note: If the controller being installed was previously used in another subsystem, it must be purged of the old configuration (refer to the `CONFIG RESET` CLI command in the *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Command Line Interface Reference Guide*).

11. Enable failover, and establish the dual-redundant controller configuration with the following command:

```
SET FAILOVER COPY=THIS_CONTROLLER
```

This command copies the subsystem configuration from “this controller” to the new controller.

12. See the *HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Command Line Reference Guide* to configure the controller.
13. Disconnect the PC or terminal from the controller maintenance port.

Upgrading cache memory

Use [Figure 122](#) and [Table 10](#) to configure the cache module.

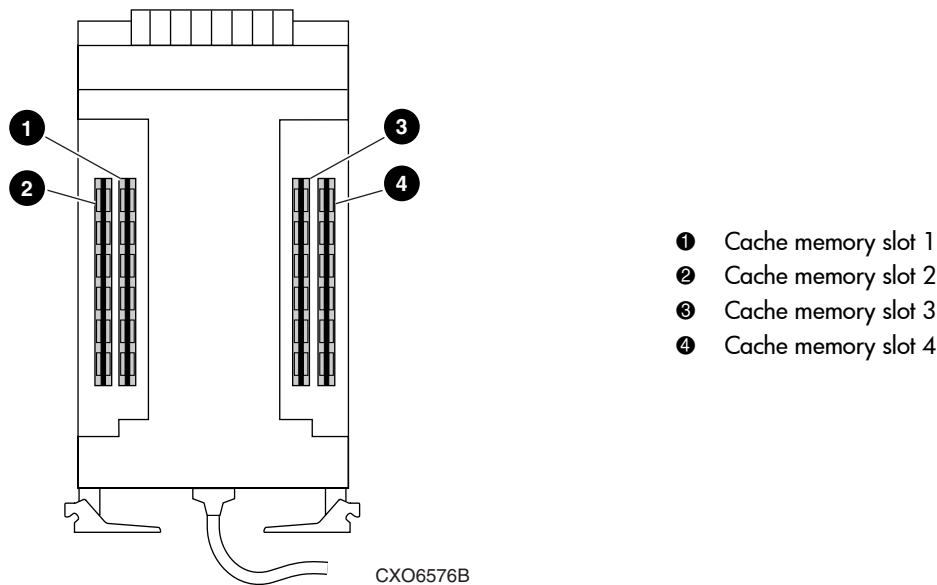


Figure 122: Cache module DIMM locations

Table 10: Cache module memory configurations

Memory	DIMMs	Quantity	Location
128 MB	32 MB	4	1 2 3 4
256 MB	128 MB	2	1 3
512 MB	128 MB	4	1 2 3 4

Note: The cache size requirement for running ACS V8.8P or V8.8S is 512 MB. For ACS V8.8F, V8.8G, and V8.8L, the minimum cache size requirement is 128 MB in unmirrored configurations and 256 MB in mirrored configurations, per cache module.

To upgrade cache module memory, shut down its controller. Use the following steps to upgrade or add DIMMs:



Caution: ESD can easily damage a cache module or a DIMM. Wear a snug-fitting, grounded ESD wrist strap during this procedure.

1. From the host console, dismount the logical units in the subsystem.
2. If using a Windows NT platform, shut down the server.
3. If the controller is operating, connect a PC or terminal to the controller maintenance port.

If the controller is not operating, proceed to [step 5](#) (on page 247).

4. Shut down the controllers:
 - In single-controller configurations, shut down “this controller” with the following command:

```
SHUTDOWN THIS_CONTROLLER
```

- In dual-redundant controller configurations, shut down the “other controller” first, and then shut down “this controller” with the following commands:

```
SHUTDOWN OTHER_CONTROLLER
```

```
SHUTDOWN THIS_CONTROLLER
```

After the controllers shut down, the **Reset** buttons and the first three LEDs are lit continuously (see [Figure 74](#)). Receiving this indication can take several minutes, depending on the amount of data that needs to be flushed from the cache modules.



Caution: For BA370 enclosures only:

- The ECB must be disabled—the status light is not lit and is not blinking—before disconnecting the ECB cable from the cache module.
 - Failure to disable the ECB can result in cache module damage.
-

5. For BA370 enclosures only:
 - a. Disable the ECB by pressing the battery disable switch until the status light stops blinking—approximately 5 seconds.
 - b. Disconnect the ECB cable from the cache module.
6. Disengage the two retaining levers on the cache module, remove the DIMM from the enclosure, and place it onto a grounded antistatic mat.
7. If adding DIMMs (see [Figure 123](#)):
 - a. Press the DIMM retaining clips down for the vacant DIMM slot.
 - b. Insert the new DIMM straight into the slot, ensuring that the notches in the DIMM align with the tabs in the slot.
 - c. Close the retaining clips to lock the DIMM into place.
 - d. Repeat [step a](#) through [step c](#) for all DIMMs being added.

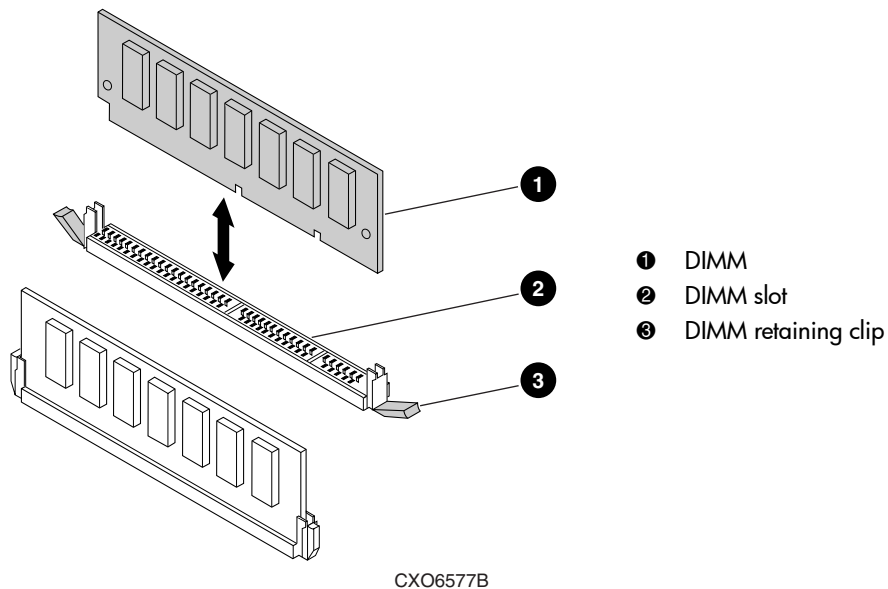


Figure 123: DIMM components

8. If replacing DIMMs (see [Figure 123](#)):
 - a. Press down on the DIMM retaining clip at both ends of the DIMM being removed.
 - b. Gently remove the DIMM from the DIMM slot.
 - c. Insert the new DIMM straight into the slot, ensuring that the notches in the DIMM align with the tabs in the slot.
 - d. Repeat [step a](#) through [step c](#) for each DIMM.
9. In a dual-redundant controller configuration, repeat [step 5](#) (on page 247) through [step 8](#), as appropriate, for the other cache module.

Note: In a dual-redundant controller configuration, both cache modules must contain the same memory configuration. Do *not* proceed unless both cache modules contain identical amounts of cache memory.



Caution: Carefully align the cache module in the appropriate guide rails. Misalignment can damage the backplane.

10. Insert the cache module into its bay and engage the retaining levers.
11. For BA370 enclosures only, connect the ECB cable to the cache module.
12. In a dual-redundant controller configuration, repeat [step 10](#) and [step 11](#), as appropriate, for the other cache module.
13. Mount the logical units on the host.
14. If using a Windows NT platform, restart the server.
15. Set the subsystem date and time by entering the following command in its entirety:


```
SET THIS_CONTROLLER TIME=dd-mm-yyyy:hh:mm:ss
```
16. Disconnect the PC or terminal from the controller maintenance port.

Specifications



This appendix covers the following topics:

- [Physical and electrical specifications for HSG60 and HSG80 array controllers and cache modules](#), page 250
- [Environmental specifications](#), page 251

Physical and electrical specifications for HSG60 and HSG80 array controllers and cache modules

Table 11 lists the physical and electrical specifications for HSG60 and HSG80 array controllers and cache modules. Voltage measurements in Table 11 are nominal measurements without tolerances.

Table 11: HSG60 and HSG80 array controllers and cache module specifications

Hardware	Width	Depth	Power	Current at +5 VDC	Current at +12 VDC
HSG60 array controller	305 mm (12 in)	241 mm (9.5 in)	26.0 W	5.2 A	
HSG80 array controller	305 mm (12 in)	241 mm (9.5 in)	29.0 W	5.8 A	
Cache module, 512 MB	138 mm (5.5 in)	241 mm (9.5 in)	8.52 W 10.5 W		Cache running diagnostics and fully charged battery (400 mA) Cache running and battery charging (880 mA)

Environmental specifications

HSG60 and HSG80 array controllers are intended for installation in a Class A environment. The operating environmental specifications are listed in [Table 12](#) and the non-operating environmental specifications are listed in [Table 13](#). These specifications are the same for all HP StorageWorks storage devices.

Table 12: Operating environmental specifications

Condition	Specification
Ambient temperature	+10 °C to +35 °C (+50 °F to +95 °F) Derate for altitude 0.5 °C per 300 m to 3,000 m (1 °F per 1,000 ft to 10,000 ft)
Relative humidity	10% to 90% at a maximum wet bulb temperature of 28 °C (82 °F)
Air quality	Not to exceed a maximum of 500,000 particles, 0.5 micron or larger, per cubic foot of air

Table 13: Non-operating environmental specifications

Condition	Specification
Storage (Up to 1 Year)	
Ambient temperature	-20 °C to +60 °C (-4 °F to +140 °F) up to 3000 m (10,000 ft)
Relative humidity	10% to 95% at a maximum wet bulb temperature of 29 °C (84 °F)
Shipping (Up to 72 Hours)	
Ambient temperature	-40 °C to +60 °C (-40 °F to +140 °F) up to 9100 m (30,000 ft)
Relative humidity	10% to 90% at a maximum wet bulb temperature of 30 °C (86 °F)

Controller and Cache Replacement Troubleshooting



This section provides instructions on resolving common problems that may occur while replacing controllers or cache modules. This section covers the following topics:

- [Resolving invalid cache error messages—serial number mismatch error messages](#), page 254
- [Resolving failed cache error messages](#), page 255
- [Resolving unexpected bugcheck condition error messages](#), page 261

Resolving invalid cache error messages—serial number mismatch error messages

An invalid cache error message may display after the `SHOW THIS_CONTROLLER` command is submitted. The controller reports that the cache and mirrored cache with cache are invalid and that the cache should be installed in a specific controller with the serial number `ZGxxxxxxx`.



Caution: Failure to clear an invalid cache message (especially a Cache is FAILED message) *before* setting the Failover mode can result in a recursive bugcheck error message that renders the controller unusable.

To resolve an invalid cache error message, see [Table 14](#).

Table 14: Resolving an invalid cache—serial number mismatch error message

	Description and Instruction
Message	INVALID CACHE - Cache should be installed in controller serial number xyz %CER-HSG> This controller (replacement) has an invalid cache module %CER-HSG> cache modules inconsistent with mirror mode
Resolution	<ol style="list-style-type: none"> 1. Submit the following command from the controller reporting the error message: <pre>CLEAR THIS_CONTROLLER (replacement) INVALID_CACHE DESTROY_UNFLUSHED_DATA</pre> <p>Note: Enter this command again if this condition is not cleared.</p> 2. Set the controller Failover mode by performing one of the following options: <ul style="list-style-type: none"> ■ Proceed to substep 9b on page 147 in the “Installing cache modules in dual-redundant controller configurations” section if the error message occurred during the cache module installation process. ■ Proceed to substep 5b on page 131 in the “Installing array controllers in dual-redundant controller configurations” section if the error message occurred during the controller installation process.

Resolving failed cache error messages



Caution: Failure to clear an invalid cache message (especially a `Cache is FAILED` message) *before* setting the Failover mode can result in a recursive bugcheck error message that renders the controller unusable.

An invalid mirrored cache error message may be displayed after one of the two following events:

Event 1: *After* setting the Failover mode

After the Failover mode is set and after the replacement controller restarts, the replacement controller CLI message indicates that its cache module is invalid. After a `SHOW THIS_CONTROLLER` or `SHOW OTHER_CONTROLLER` command is submitted, the controller displays one or both of the following cache conditions:

```
Cache: Cache is GOOD
```

```
Mirrored Cache: Cache is FAILED
```

Note: This condition cannot be resolved with the `CLEAR OTHER_CONTROLLER INVALID_CACHE DESTROY_UNFLUSHED_DATA` command.

To resolve the error message, see [Table 15](#) on page 257.



Caution: The resolution for a failed cache error message in [Table 15](#) on page 257 involves the interruption of service to the customer. Notify your manager and customers of this situation, *and* make sure that the controllers are not in use *before* proceeding to resolve a failed cache condition. Avoiding this precaution may result in data loss.

■ Event 2: *Before* setting the Failover mode

Before Failover mode is set and after the replacement controller restarts following the **Port #5** button reset process (see [substep 2c](#) through [substep 2f](#) on page 128), the replacement controller CLI message indicates that the

mirrored cache is in a failed condition. When a `SHOW THIS_CONTROLLER` command is submitted, the replacement controller indicates that its mirrored cache is in a Failed state:

```
Cache: Cache is GOOD
```

```
Mirrored Cache: Cache is FAILED
```

[Table 16](#) on page 259 provides instructions for resolving the above event. If the failure cannot be cleared using the procedures in [Table 16](#) on page 259, a defective hardware component may exist. If this is the case, identify which component is defective, and replace it.

Table 15: Resolving a failed cache error message (event 1)


	Details
Message	%CER-Atop> This controller (replacement) has an invalid cache module
Resolution	<div>  <p>Caution: If the cache failed, disable mirrored cache to clear the failed condition. Since unmirroring a controller pair destroys all persistent reservation bits in the controllers, you must halt all host activity to this controller pair before proceeding.</p> </div> <hr/> <p>Complete the following steps to resolve a failed cache module (event 1) error message:</p> <ol style="list-style-type: none"> 1. Connect a PC or terminal to the maintenance port of the operational controller if not already connected. 2. Halt all host I/O activity. 3. Unmount all devices. 4. Complete the instructions for removing a cache module in the “Removing cache modules in dual-redundant controller configurations” section that starts on page 139. 5. Complete the instructions for installing a cache module in the “Installing cache modules in dual-redundant controller configurations” section that starts on page 142. Doing this causes cache diagnostics to be performed and should repair the bad cache condition. 6. Display configuration information for both controllers by entering the following commands: <pre>SHOW THIS_CONTROLLER SHOW OTHER_CONTROLLER</pre> 7. Verify whether the cache and mirrored cache are good (Cache is GOOD), and then complete one the following two options: <ul style="list-style-type: none"> ■ If the cache is good, return the controller to service. The resolution of the failed cache condition is complete. ■ If the cache is failed, complete step 8 through step 11 on page 258.

Table 15: Resolving a failed cache error message (event 1) (continued)

	Details
Resolution (Cont'd)	<div data-bbox="325 309 396 378"></div> <p data-bbox="415 309 1268 456">Caution: In step 8, you must break up mirrored cache. Before completing this step, note that breaking up mirrored cache configurations loses persistent reservation conditions on the units in these controllers. Before proceeding with this procedure, inform customers and your manager that you are about to break the mirror cache configuration.</p> <hr/> <p data-bbox="325 522 1239 574">8. Break the controller pair mirrored cache configuration by entering the following command:</p> <pre data-bbox="368 595 799 616">SET THIS_CONTROLLER NOMIRRORED</pre> <p data-bbox="368 633 619 656">Both controllers restart.</p> <p data-bbox="325 670 1193 699">9. Check cache status of both controllers by entering the following commands:</p> <pre data-bbox="368 716 656 737">SHOW THIS_CONTROLLER</pre> <pre data-bbox="368 756 669 777">SHOW OTHER_CONTROLLER</pre> <p data-bbox="325 791 1203 847">10. If the cache is good, complete the following substeps. Otherwise, proceed to step 11.</p> <p data-bbox="368 861 1179 913">a. Set the controllers into mirrored cache status by entering the following command:</p> <pre data-bbox="415 930 818 951">SET THIS_CONTROLLER MIRRORED</pre> <p data-bbox="415 968 666 991">Both controllers restart.</p> <p data-bbox="368 1005 1205 1060">b. Verify whether the controller configuration is mirrored and whether both cache and mirrored cache are good (Cache is GOOD).</p> <p data-bbox="368 1074 1225 1130">c. If the cache is good, return the controller pair to service. Resolution to the failed cache condition is complete. If the cache failed, proceed to step 11.</p> <p data-bbox="325 1133 1205 1189">11. If the cache failed (Cache is FAILED), attempt to clear the invalid cache condition by entering the following command:</p> <pre data-bbox="415 1206 1003 1251">CLEAR_ERROR THIS_CONTROLLER INVALID_CACHE DESTROY_UNFLUSHED_DATA</pre> <p data-bbox="368 1269 1268 1376">If the attempt to clear the failed cache is unsuccessful, a failed cache module is installed, or the DIMMs failed. Refer to the <i>HP StorageWorks HSG60 and HSG80 Array Controller and Array Controller Software Troubleshooting Guide</i>, or contact HP technical support for additional help.</p>

Table 16: Resolving a failed cache error message (event 2)


	Details
Message	%CER-Atop> This controller (replacement) has an invalid cache module
Resolution	<div>  <p>Caution: If the cache failed, you must disable mirrored cache in order to clear the failed condition. Because unmirroring a controller pair destroys all persistent reservation bits in the controllers, you must halt all host activity to this controller pair <i>before</i> proceeding.</p> </div> <hr/> <p>Complete the following steps to resolve an invalid cache module error message.</p> <ol style="list-style-type: none"> 1. Connect a PC or terminal to the maintenance port of the replacement controller if not already connected. If you are returning to this step after attempting to resolve a failed cache condition, proceed to step 6 below. 2. Halt all host I/O activity to the controller pair. 3. Unmount all units. 4. Complete the instructions for removing a cache module in the “Removing cache modules in dual-redundant controller configurations” section that starts on page 139. 5. Complete the instructions for installing a cache module in the “Installing cache modules in dual-redundant controller configurations” section that starts on page 142, and then proceed to the next step. 6. Verify whether the cache and mirrored cache are good (Cache is GOOD), and then complete one of the following two options: <ul style="list-style-type: none"> ■ If the cache is good, return the controller pair to service. The resolution of the failed cache condition is complete. ■ If the cache is failed, complete the following substeps: <ol style="list-style-type: none"> a. Complete substep 3a through substep 3d, which start on page 123, to remove the controller. b. Remove the “other controller.” c. Clear the NV configuration by lifting the Holddown tab on the lithium battery. d. See step 6 through step 11 in Table 17 (on page 261) to restore the minimum operating configuration of the controller. Then proceed to the “Installing cache modules in dual-redundant controller configurations” section that starts on page 142 to continue.

Table 16: Resolving a failed cache error message (event 2) (continued)

	Details
Resolution (continued)	<ul style="list-style-type: none">e. After restoring defaults, complete the instructions for installing a controller in the “Installing array controllers in dual-redundant controller configurations” section that starts on page 126.f. Return controller pair to service.

Resolving unexpected bugcheck condition error messages

If the replacement controller restarts at the same time you press **Enter** or **Return** to terminate *FRUTIL* on the operational controller, an unexpected bugcheck condition error message can occur.

Note: This condition cannot be cleared with CLI commands. The NVRAM of the replacement controller must be erased by lifting a contact tab to the lithium battery on the controller (which causes the controller NVRAM to return to a basic configuration without a controller serial number present). It is necessary to run the **DANGEROUS** command to restore the controller.

See [Table 17](#) for procedures on resolving the unexpected bugcheck condition error message.

Table 17: Resolving an unexpected bugcheck condition error message

	Resolution
Message	UNEXPECTED BUGCHECK CONDITION - LAST FAILURE CODE: 120E0310LAST FAILURE CODE: 120F0310%FLL---28-MAY-2003 17:50:08-- OCP Code: 30An unexpected bugcheck occurred before subsystem initialization completed. Exec flags: 00000039 RIP: C013154C System Information Valid: Yes Last Failure Code: 120E0310 (No Last Failure Parameters) -OR-Last Failure Code: 120F0310 (No Last Failure Parameters)
Resolution	<ol style="list-style-type: none"> 1. Display configuration information for both controllers (if possible) by entering the following commands from the operational controller: <pre>SHOW THIS_CONTROLLER FULL</pre> <pre>SHOW OTHER_CONTROLLER FULL (if possible)</pre> <p>If you are unable to submit the <code>SHOW OTHER_CONTROLLER FULL</code> command above, proceed to the next step.</p>

Table 17: Resolving an unexpected bugcheck condition error message (continued)

Resolution	Resolution
Resolution (Cont'd)	<ol style="list-style-type: none"> 2. Record all controller configuration information for both controllers, if possible. Otherwise, record controller configuration information for the operational controller only, and proceed to the next step. 3. Shut down the operational controller by entering the following command: <code>SHUTDOWN THIS_CONTROLLER</code> 4. Disconnect the PC or terminal from the operational controller. 5. Connect a PC or terminal to the maintenance port of the failed controller. 6. Set the hardware version and manufacturing level by entering the following command: <code>DANGEROUS X HARDWARE=" xyz "</code>
	<p>Note: The <i>xyz</i> in the above command represents the hardware version that is located on the label on the bottom (component side) of the controller board.</p>
	<ol style="list-style-type: none"> 7. Set the serial number by entering the following command: <code>DANGEROUS X SERIAL=" ZGxxxxxxxx "</code>
	<p>Note: The <i>xxxxxxxx</i> in the above command represents the serial number of the controller which is located on the label on the bottom (component side) of the controller board.</p>
	<ol style="list-style-type: none"> 8. Shut down the failed controller. 9. Disconnect the PC or terminal from the maintenance port of the failed controller. 10. Disengage the failed controller, but do not remove it. 11. Disengage the program card of the failed controller, but do not remove it.

glossary

This glossary defines terms used in this guide or related to this product and is not a comprehensive glossary of computer terms.

ACS

Array Controller Software. The software component of the array controller storage systems. ACS executes on the array controller and processes input and output requests from the host, performing the device-level operations required to satisfy the requests.

adapter

A device that converts the protocol and hardware interface of one bus type into that of another without changing functionality of the bus.

array controller

See controller.

array controller software

See ACS.

autospare

An array controller feature that automatically replaces a failed disk drive. Autospare aids the array controller in automatically replacing failed disk drives. You can enable the *AUTOSPARE* switch for the failedset causing physically replaced disk drives to be automatically placed into the spareset. *Also called* autonewspare.

backplane

The electronic printed circuit board into which you plug subsystem devices—for example, an array controller or power supply.

battery hysteresis

The ability of the software to allow write-back caching during the time a battery is charging, but only when a previous downtime has not drained more than 50 percent of rated battery capacity.

bit

A single binary digit having a value of either 0 or 1. A bit is the smallest unit of data a computer can process.

byte

A binary character string made up of 8 bits operated on as a unit.

cache memory

A portion of memory used to accelerate read and write operations. The objective of caching data in a system is to improve performance by placing the most frequently used data in the highest performance memory.

cache module

A fast storage buffer.

channel

An interface which allows high speed transfer of large amounts of data. Another term for a SCSI bus. *See also* SCSI.

chunk

In any form of RAID that stripes data, data is stored in pieces called chunks. One chunk is stored on each member device in the unit. Taken together, the chunks make up a stripe. The chunk size can be used in some controllers to tune the stripeset for a specific application.

CI bus

Computer Interconnect bus. A serial 70 MHz, dual path, party-line, bus. It is the host bus for the HSG-series controller-based storage systems. The CI bus is used by OpenVMS hosts to connect the nodes in a clustered subsystem.

CLCP

Code-Load Code-Patch utility. This utility can be used to download patches to the Array Controller Software.

CLI

Command Line Interpreter. A command line entry utility used to interface with HSG60 and HSG80 controllers. CLI enables the configuration and monitoring of a storage subsystem through textual commands.

code-load code-patch utility

See CLCP.

command line interpreter

See CLI.

computer interconnect bus

See CI bus.

container

(1) Any entity that is capable of storing data, whether it is a physical device or a group of physical devices. (2) A virtual, internal controller structure representing either a single disk or a group of disk drives linked as a storageset. Stripesets and mirrorsets are examples of storageset containers that the array controller uses to create units.

See also storage unit.

controller

A hardware device that, with proprietary software, facilitates communications between a host and one or more storage devices organized in a storage array. The HSG60 and HSG80 controllers of the HP StorageWorks family of controllers are all array controllers.

data center cabinet (rack)

A generic reference to large subsystem racks, such as those in which HP StorageWorks products can be mounted.

DDL

Dual data link. The ability to operate on the CI bus using both paths simultaneously to the same remote node.

device

In its physical form, a magnetic disk that can be attached to a SCSI bus. The term is also used to indicate a physical device that is made part of a controller configuration; that is, a physical device that is known to the array controller. Units (virtual disks) can be created from devices, once the devices have been made known to the array controller.

The targets, initiators, hubs, converters, adapters, and similar items interconnected to form a SCSI bus. Connectors, expanders, and hubs do not use a SCSI bus ID. *See also* node and peripheral device.

DIMM

Dual Inline Memory Module.

dirty data

The write-back cached data that has not been written to storage media, even though the host operation processing the data has completed.

DOC

DWZZA-on-a-chip. An SYM53C120 SCSI bus extender chip used to connect a SCSI bus in one enclosure to the corresponding SCSI bus in another enclosure.

driver

A hardware device or a program that controls or regulates another device. For example, a device driver is a driver developed for a specific device that allows a computer to operate with the device, such as a printer or a disk drive.

dual data link

See DDL.

dual-redundant configuration

An array controller configuration consisting of two active controllers operating as a single controller. If one controller fails, the other controller assumes control of the failing controller devices.

ECB

External Cache Battery. The unit that supplies backup power to the cache module in the event the primary power source fails or is interrupted.

EIA

Electronic Industries Association. EIA is a standards organization specializing in the electrical and functional characteristics of interface equipment.

EMU

Environmental Monitoring Unit. A unit that provides increased protection against catastrophic failures. Some subsystem enclosures include an EMU which works with the array controller to detect conditions such as failed power supplies, failed blowers, elevated temperatures, and external air sense faults. The EMU also controls certain rack hardware including DOC chips, alarms, and fan speeds.

environmental monitoring unit

See EMU.

extended subsystem

A subsystem in which one or two enclosures are connected to the primary enclosure.

external cache battery

See ECB.

failedset

A group of disk drives that have been removed from RAIDsets due to a failure or a manual removal. Disk drives in the failedset should be considered defective and should be tested and repaired before being placed back into the spareset. *See also* spareset.

failover

The process that takes place when one controller in a dual-redundant configuration assumes the workload of a failed companion controller. Failover continues until the failed controller is repaired or replaced. *See also* failback.

fault management utility

See FMU.

fiber

A fiber or optical strand. Spelled *fibre* in Fibre Channel.

fiber optic cable

A transmission medium designed to transmit digital signals in the form of pulses of light. Fiber optic cable is noted for its properties of electrical isolation and resistance to electrostatic contamination.

flush

The act of writing dirty data from cache to a storage media. *See also* dirty data.

FMU

Fault Management Utility. A utility that is run to provide fault or error reporting information.

FRU

Field Replaceable Unit. A hardware component that can be replaced at a customer location by HP authorized service providers.

FRUTIL

Field Replacement Utility.

GBIC

Gigabit Interface Converter. The devices that are inserted into the ports of the Fibre Channel switch and that hold the Fibre Channel cables.

giga

A prefix indicating a billion (10^9) units, as in gigabaud or gigabyte.

gigabyte

A value normally associated with disk drive storage capacity, meaning a billion (10^9) bytes. The decimal value 1024 is usually used for one thousand.

GLM

Gigabit link module.

host

The primary or controlling computer to which a storage subsystem is attached.

host adapter

A device that connects a host system to a SCSI bus. The host adapter usually performs the lowest layers of the SCSI protocol. This function may be logically and physically integrated into the host system.

host compatibility mode

A setting used by the array controller to provide optimal controller performance with specific operating systems. This improves array controller performance and compatibility with the specified operating system.

hot-pluggable

A replacement method that allows normal I/O activity on a device bus to remain active during device removal and insertion. The device being removed or inserted is the only device that cannot perform operations during this process. *See also* pluggable.

hot swap

A device remove and replace procedure using hot-pluggable method.

HP StorageWorks

The HP brand name for a family of modular data storage products that allows customers to design and configure their own storage subsystems. Components include power, packaging, cabling, devices, controllers, and software. Customers can integrate devices and array controllers in HP StorageWorks enclosures to form storage subsystems. HP StorageWorks systems include integrated devices and array controllers to form storage subsystems.

HSUTIL

Format and Device Code Load Utility.

I/O

Refers to input and output functions.

I/O interface

See interface.

I/O module

A device that integrates an enclosure with either an 8-bit single-ended SCSI bus, 16-bit single-ended SCSI bus, 16-bit differential SCSI bus, or Fibre Channel bus.

I/O operation

The process of requesting a transfer of data from a peripheral device to memory (or visa versa), the actual transfer of the data, and the processing and overlaying activity to make both of those happen.

interface

A set of protocols used between components, such as cables, connectors, and signal levels.

LBN

Logical Block Number. A volume-relative address of a block on a mass storage device. The blocks that form the volume are labeled sequentially starting with LBN 0.

LED

Light-emitting diode.

link

A connection between two Fibre Channel ports consisting of a transmit fibre and a receive fibre.

local connection

A connection to the subsystem, by way of the array controller serial maintenance port, to a maintenance terminal or the host terminal. A local connection enables you to connect to one subsystem controller to perform maintenance tasks. *See also* maintenance terminal and local terminal.

local terminal

A terminal plugged into the EIA-423 maintenance port located on the front bezel of the array controller. *See also* maintenance terminal and local connection.

logical block number

See LBN.

logical bus

A single-ended bus connected to a differential bus by a SCSI bus signal converter.

logical unit

A physical or virtual device addressable through a target ID number. LUNs use their target's bus connection to communicate on the SCSI bus. *See also* unit.

logical unit number

See LUN.

LUN

Logical Unit Number. A value that identifies a specific logical unit belonging to a SCSI target ID number. A number associated with a physical device unit during a task's I/O operations. Each task in the system must establish its own correspondence between logical unit numbers and physical devices. *See also* logical unit.

maintenance terminal

An EIA-423-compatible terminal used with the array controller. This terminal is used to identify the array controller, enable host paths, enter configuration information, and check the array controller status. The maintenance terminal is not required for normal operations. *See also* local terminal and local connection.

member

A container that is a storage element in a RAID array.

mirroring

The act of creating an exact copy or image of data.

mirrorset

See RAID-1.

network

A data communication, a configuration in which two or more terminals or devices are connected to enable information transfer.

N-m

Newton-meter. The metric equivalent to inch-pounds of torque.

node

(3) In Fibre Channel, a device that has at least one N_Port or NL_Port.

nonredundant controller configuration

(1) A single-controller configuration. (2) An array controller configuration that does not include a second controller.

OCP

Operator control panel. The control and indicator panel associated with an array controller. The OCP is mounted on the array controller and is accessible to the operator

operator control panel

See OCP.

“other controller”

The array controller in a dual-redundant pair that is connected to the array controller serving your current CLI session. *See also* “this controller.”

parity

A method of checking if binary numbers or characters are correct by counting the ONE bits. In odd parity, the total number of ONE bits must be odd; in even parity, the total number of ONE bits must be even. Parity information can be used to correct corrupted data. RAIDsets use parity to improve the availability of data.

parity bit

A binary digit added to a group of bits that checks to see if errors exist in the transmission.

parity check

A method of detecting errors when data is sent over a communications line. With even parity, the number of ones in a set of binary data should be even. With odd parity, the number of ones should be odd.

PCMCIA

Personal Computer Memory Card Industry Association. An international association formed to promote a common standard for PC card-based peripherals to be plugged into notebook computers. The card, commonly known as a PCMCIA card or program card, is about the size of a credit card. *See also* program card.

peripheral device

Any unit, distinct from the CPU and physical memory, that can provide the system with input or accept any output from it. Terminals, printers, tape drives, and disks are peripheral devices.

pluggable

A replacement method that allows the complete system to remain online during device removal or insertion. The system bus must be halted, or quiesced, for a brief period of time during the replacement procedure. *See also* hot-pluggable.

port

In general terms, the port is:

- A logical channel in a communications system.
- The hardware and software used to connect a host controller to a communications bus, such as a SCSI bus or serial bus.

Regarding the array controller, the port is:

- The logical route for data in and out of an array controller that can contain one or more channels, all of which contain the same type of data.
- The hardware and software that connects an array controller to a SCSI device.

primary enclosure

The primary enclosure is the subsystem enclosure that contains array controllers, cache modules, external cache batteries, and the PVA module.

program card

The PCMCIA card containing HSG60 or HSG80 array controller operating software. *See also* PCMCIA.

protocol

The conventions or rules for the format and timing of messages sent and received.

PTL

Port-Target-LUN. The array controller method of locating a device on the array controller device bus.

PVA module

Power Verification and Addressing module.

quiesce

The act of rendering bus activity inactive or dormant. For example, quiesce the SCSI bus operations during a device warm swap.

RAID

Redundant array of independent disks. Represents multiple levels of storage access developed to improve performance or availability, or both.

RAID-0

A RAID storage set that stripes data across an array of disk drives. A single logical disk spans multiple physical disks, allowing parallel data processing for increased I/O performance. While the performance characteristics of RAID-0 is excellent, this RAID level is the only one that does not provide redundancy. RAID-0 storage sets are sometimes referred to as stripe sets.

RAID 0+1

A RAID storage set that stripes data across an array of disks (RAID-0) and mirrors the striped data (RAID-1) to provide high I/O performance and high availability. RAID 0+1 storage sets are sometimes referred to as striped mirror sets.

RAID-1

A RAID storage set of two or more physical disks that maintains a complete and independent copy of the entire virtual disk's data. This type of storage set has the advantage of being highly reliable and extremely tolerant of device failure. RAID-1 storage sets are sometimes referred to as mirror sets.

RAID-3

A RAID storage set that transfers data parallel across the array's disk drives a byte at a time, causing individual blocks of data to be spread over several disks serving as one enormous virtual disk. A separate redundant check disk for the entire array stores parity on a dedicated disk drive within the storage set. *See also* RAID-5.

RAID 3/5

A specially developed RAID storage set that stripes data and parity across three or more members in a disk array. A RAID set combines the best characteristics of RAID-3 and RAID-5. A RAID set is the best choice for most applications with small to medium I/O requests, unless the application is write intensive. A RAID set is sometimes called parity RAID. RAID 3/5 storage sets are sometimes referred to as RAID sets.

RAID-5

A RAID storage set that, unlike RAID-3, stores the parity information across all of the disk drives within the storage set. *See also* RAID-3.

RAID set

See RAID 3/5.

reconstruction

The process of regenerating the contents of a failed member's data. The reconstruct process writes the data to a spare set disk and then incorporates the spare set disk into the mirror set, striped mirror set, or RAID set from which the failed member came. *See also* regeneration.

reduced

A term that indicates that a mirrorset or RAIDset is missing one member because the member failed or was physically removed.

redundancy

The provision of multiple interchangeable components to perform a single function in order to cope with failures and errors. A RAIDset is considered to be redundant when user data is recorded directly to one member and all of the other members include associated parity information.

regeneration

(1) The process of calculating missing data from redundant data. (2) The process of recreating a portion of the data from a failing or failed disk drive using the data and parity information from the other members within the storageset.

The regeneration of an entire RAIDset member is called reconstruction. *See also* reconstruction.

SCSI

Small Computer System Interface. (1) An American National Standards Institute (ANSI) interface standard defining the physical and electrical parameters of a parallel I/O bus used to connect initiators to devices. (2) A processor-independent standard protocol for system-level interfacing between a computer and intelligent devices including hard drives, floppy disks, CD-ROMs, printers, scanners, and others.

replacement policy

The policy specified by a switch with the `SET FAILEDSET` command indicating whether a failed disk from a mirrorset or RAIDset is to be automatically replaced with a disk from the spareset. The two switch choices are *AUTOSPARE* and *NOAUTOSPARE*.

SCSI device

(1) A host computer adapter, a peripheral controller, or an intelligent peripheral that can be attached to the SCSI bus. (2) Any physical unit that can communicate on a SCSI bus.

SCSI device ID number

A bit-significant representation of the SCSI address referring to one of the signal lines, numbered 0 through 7 for an 8-bit bus, or 0 through 15 for a 16-bit bus. *See also* target ID number.

SCSI ID number

The representation of the SCSI address that refers to one of the signal lines numbered 0 through 15.

SCSI port

(1) Software: The channel controlling communications to and from a specific SCSI bus in the system. (2) Hardware: The name of the logical socket at the back of the system unit to which a SCSI device is connected.

single ended I/O module

A 16-bit I/O module. *See also* I/O module.

single-ended SCSI bus

An electrical connection where one wire carries the signal and another wire or shield is connected to electrical ground. Each signal logic level is determined by the voltage of a single wire in relation to ground. This is in contrast to a differential connection where the second wire carries an inverted signal.

spareset

A collection of disk drives used by the array controller to replace failed members of a storageset.

storage array

An integrated set of storage devices.

storage array subsystem

See storage subsystem.

storage subsystem

The array controllers, storage devices, shelves, cables, and power supplies used to form a mass storage subsystem.

storage unit

The general term that refers to storagesets, single-disk units, and all other storage devices that are installed in your subsystem and accessed by the host. A storage unit can be any entity that is capable of storing data, whether it is a physical device or a group of physical devices. *See also* container.

storageset

(1) A group of devices configured with RAID techniques to operate as a single container. (2) Any collection of containers, such as stripesets, mirrorsets, striped mirrorsets, and RAIDsets.

stripe

The data divided into blocks and written across two or more member disks in an array.

striped mirrorset

See RAID 0+1.

stripeset

See RAID-0.

tape

A storage device supporting sequential access to variable sized data records.

target

(1) A SCSI device that performs an operation requested by an initiator. (2) Designates the target identification (ID) number of the device.

target ID number

The address a bus initiator uses to connect with a bus target. Each bus target is assigned a unique target address.

“this controller”

The array controller that is serving your current CLI session through a local or remote terminal. *See also* “other controller.”

transfer data rate

The speed at which data may be exchanged with the central processor, expressed in thousands of bytes per second.

Ultra SCSI bus

A Fast-20 SCSI bus.

uninterruptible power supply

See UPS.

unit

A container made accessible to a host. A unit may be created from a single disk drive. A unit may also be created from a more complex container such as a RAIDset. The array controller supports a maximum of eight units on each target. *See also* target and target ID number.

UPS

Uninterruptible power supply. A battery-powered power supply guaranteed to provide power to an electrical device in the event of an unexpected interruption to the primary power supply. Uninterruptible power supplies are usually rated by the amount of voltage supplied and the length of time the voltage is supplied.

VHDCI

Very High-Density-Cable Interface. A 68-pin interface that is required for Ultra SCSI connections.

virtual terminal

A software path from an operator terminal on the host to the array controller CLI, sometimes called a host console. The path can be established through the host port on the array controller or through the maintenance port through an intermediary host. *See also* maintenance terminal.

warm swap

A device remove and replace procedure using hot-pluggable method.

write-back cache

See cache module.

write-back caching

A cache management method used to decrease the subsystem’s response time to write requests by allowing the array controller to declare the write operation complete as soon as the data reaches its cache memory. The array controller performs the slower operation of writing the data to the disk drives at a later time.

write-through cache

A cache management technique for retaining host write requests in read cache. When the host requests a write operation, the array controller writes data directly to the storage device. This technique allows the array controller to complete some read requests from the cache, greatly improving the response time to retrieve data. The operation is complete only after the data to be written is received by the target storage device.

This cache management method may update, invalidate, or delete data from the cache memory accordingly, to ensure that the cache contains the most current data.

write-through caching

A cache management method used to decrease subsystem response time to a read. This method allows the array controller to satisfy the request from the cache memory rather than from the disk drives.

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